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## Terms and abbreviations

<table>
<thead>
<tr>
<th>Term/abbreviation</th>
<th>Definition</th>
</tr>
</thead>
</table>
| Actual start date | The first date on which:  
• costs are charged to the project budget,  
• the work of the last person involved in the implementation of the project begins. |
| Actual end date   | The last date on which:  
• costs are charged to the project budget,  
• the work of the first person involved in the implementation of the project ends. |
| API               | Application Programming Interface, a defined dataset that makes it possible to exchange information (between applications). |
| Call              | Official publication describing the objective, available budget, conditions, assessment criteria, procedure and timeline of a funding round. For a complete list see article 2.1.2. of the [NWO Grant Rules 2017](#). |
| Co-applicant      | The person or institution that applies for a grant together with the main applicant. |
| Coordinator       | Person(s) within NWO responsible for the process-based implementation of a financial instrument and/or round. |
| File number       | A unique combination of numbers and/or letters and/or punctuation marks by which a NWO research project is identified |
| Main Applicant    | The person or institution that acts (on behalf of several applicants) as a contact person for NWO; is also the intended project leader. |
| NWO Domain        | One of the organizational units within NWO where the following tasks are carried out:  
• developing, establishing and implementing the policy for the relevant domain;  
• making proposals to the Board of the Domain for new funding instruments and adapting existing instruments;  
• The board of the Domain takes decisions about the awarding of funds. |
| Product           | (Scientific) output from a project funded by NWO, like a publication, book chapter, conference paper or other output. |
| Project           | Research project by one or more people for which an NWO grant has been awarded to achieve a goal within a set time and with a set budget. |
| Project manager   | The person employed by the knowledge institution who bears the final responsibility for the content and finances of the project, as mentioned in Article 5.1 of the [NWO Grant Rules 2017](#). |
| Proposal          | A research proposal from an applicant to provide financial resources for proposed research. |
| Public summary    | A brief description of the content of an research proposal or project of between 50 and 100 words explaining the essence of the application or project in language understandable to the general public. |
| Researcher        | Executor:  
• Scientific staff, staff who carry out the research.  
• Non-scientific staff, staff who support research being carried out. |
| Scientific summary| An abbreviated version of the scientific content of a research proposal or project in which the main points are highlighted for the assessment by referees and by a committee or jury members. |
| Title             | Designation of the output of a product, or the title of a project. |
1 Explanation NWOpen-API

By making the NWOpen-API available, NWO wants to further contribute to openness and transparency of the process and the scientific (output) of the research. With the NWOpen-API it is possible to consult information from NWO and, if desired, it is possible to enrich your own systems with this information.

The information provided by the API is limited to projects funded by NWO. The information provided by the API can also be found in the NWO project database, www.nwo.nl/en/projects. The API includes data from projects started in 2016 and later.

NWO strives for the highest possible percentage of available project information. The information returned by the API pertains solely to projects that have been marked as publicly available. This means that projects that have been designated as "do not publish" by the project leader, or projects where the call has been designated as "do not publish" by NWO, will not be returned by the API. Therefore, it is not possible to reproduce the results that can be found in the NWO annual report on the basis of the data from the API.

Disclaimer

NWO cannot accept responsibility for conclusions drawn by third parties based on the data provided by NWOpen-API. NWO is not responsible for the use and processing by third parties of the data provided by the API.
## 2 API Description

### 2.1 Project information input

The NWOpen API uses the HTTP Get method. Project information can be retrieved by providing one or more optional parameters in the URL when calling the API. The API can be called by using the URL:

```
nwopen-api.nwo.nl/NWOpen-API/api/Projects
```

The possible input parameters are described in the table below. For words provided in the string inputs whole words will be matched, not parts of the words. For example, if you need to search for a person named Janssen, only results are provided when searched for Janssen, not for Jan or Jans.

<table>
<thead>
<tr>
<th>Field name</th>
<th>Datatype</th>
<th>Definition</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>project_id</td>
<td>String (100)</td>
<td>Unique identifier, this is the file number assigned by NWO to a project.</td>
<td>Equals</td>
</tr>
<tr>
<td>organisation</td>
<td>String (255)</td>
<td>Name of the organization. In the case the name of the organisation consists of multiple words, double quotes can be used, for example “University of City X”</td>
<td>Contains</td>
</tr>
<tr>
<td>title</td>
<td>String (255)</td>
<td>Title of a project, searched for like %Title%.</td>
<td>Contains</td>
</tr>
<tr>
<td>rs_start_date</td>
<td>Date (YYYY-MM-DD)</td>
<td>Range Start for the actual start date. Together with the RE_StartDate, forms the selection period for projects started between RS_StartDate and RE_StartDate.</td>
<td>Greater than or equal to</td>
</tr>
<tr>
<td>re_start_date</td>
<td>Date (YYYY-MM-DD)</td>
<td>Range End for the actual start date. Together with the RS_StartDate, forms the selection period for projects started between RS_StartDate and RE_StartDate.</td>
<td>Less than or equal to</td>
</tr>
<tr>
<td>rs_end_date</td>
<td>Date (YYYY-MM-DD)</td>
<td>Range Start for the actual end date. Together with the RE_EndDate, forms the selection period for projects started between RS_EndDate and RE_EndDate.</td>
<td>Greater than or equal to</td>
</tr>
<tr>
<td>re_end_date</td>
<td>Date (YYYY-MM-DD)</td>
<td>Range End for the actual end date. Together with the RS_EndDate, forms the selection period for projects started between RS_EndDate and RE_EndDate.</td>
<td>Less than or equal to</td>
</tr>
<tr>
<td>member_last_name</td>
<td>String (255)</td>
<td>Last name of a member of a project.</td>
<td>Equals</td>
</tr>
<tr>
<td>role</td>
<td>String (100)</td>
<td>Role of a person within a project. The roles that can be searched for are:</td>
<td>Equals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Main Applicant</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Co-applicant</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Project leader</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Researcher</td>
<td></td>
</tr>
<tr>
<td>per_page</td>
<td>Integer</td>
<td>Number of rows to be returned for the requested page. Minimum of 1, Maximum of 100. When left empty, the maximum number will be returned.</td>
<td>Equals</td>
</tr>
<tr>
<td>page</td>
<td>Integer</td>
<td>Pagenumber, used to return the next page with results based on the per_page input parameter.</td>
<td>Equals</td>
</tr>
</tbody>
</table>
2.2 Project information output

2.2.1 Structure

The information is returned in a tree structure. The structure used is as follows:

```
{
   "meta": {

   },
   "projects": [
    {
      "summary_updates": [
       {
       
      }
      ],
      "project_members": [
       {
       
      }
      ],
      "products": [
       {
         "authors": [
          {
          
         }
         
       ]
       }
      }
      
    }
   
  }
```

The following sections describe the information returned at the different levels of the tree structure described.

2.2.2 meta

<table>
<thead>
<tr>
<th>Field name</th>
<th>Datatype</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>api_type</td>
<td>String</td>
<td>Name of the call.</td>
</tr>
<tr>
<td>version</td>
<td>String</td>
<td>Version of the API.</td>
</tr>
<tr>
<td>release_date</td>
<td>Date (YYYY-MM-DD)</td>
<td>API release date.</td>
</tr>
<tr>
<td>funder</td>
<td>String</td>
<td>Crossref-ID of NWO.</td>
</tr>
<tr>
<td>ror_id</td>
<td>String</td>
<td>RORid of NWO.</td>
</tr>
<tr>
<td>project_id</td>
<td>String (100)</td>
<td>File number used to call the API. Is provided when it was used to call the API.</td>
</tr>
<tr>
<td>organisation</td>
<td>String (255)</td>
<td>Organization name used to call the API. Is provided when it was used to call the API.</td>
</tr>
<tr>
<td>Field name</td>
<td>Datatype</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>title</td>
<td>String (255)</td>
<td>Title of a project used to call the API. Is provided when it was used to call the API.</td>
</tr>
<tr>
<td>rs_start_date</td>
<td>Date (YYYY-MM-DD)</td>
<td>Range Start for the actual start date used to call the API. Is provided when it was used to call the API.</td>
</tr>
<tr>
<td>re_start_date</td>
<td>Date (YYYY-MM-DD)</td>
<td>Range End for the actual start date used to call the API. Is provided when it was used to call the API.</td>
</tr>
<tr>
<td>rs_end_date</td>
<td>Date (YYYY-MM-DD)</td>
<td>Range Start for the actual end date used to call the API. Is provided when it was used to call the API.</td>
</tr>
<tr>
<td>re_end_date</td>
<td>Date (YYYY-MM-DD)</td>
<td>Range End for the actual end date used to call the API. Is provided when it was used to call the API.</td>
</tr>
<tr>
<td>role</td>
<td>String (100)</td>
<td>Role of a person within a project used to call the API. Is provided when it was used to call the API.</td>
</tr>
<tr>
<td>member_last_name</td>
<td>String (255)</td>
<td>Last name of a member of a project used to call the API. Is provided when it was used to call the API.</td>
</tr>
<tr>
<td>date</td>
<td>Date (YYYY-MM-DD)</td>
<td>Date the API call was made.</td>
</tr>
<tr>
<td>count</td>
<td>Integer</td>
<td>Number of rows that make up the result.</td>
</tr>
<tr>
<td>per_page</td>
<td>Integer</td>
<td>The maximum number of rows returned per call.</td>
</tr>
<tr>
<td>pages</td>
<td>Integer</td>
<td>Number of pages that make up the result.</td>
</tr>
<tr>
<td>page</td>
<td>Integer</td>
<td>The returned page number.</td>
</tr>
<tr>
<td>error</td>
<td>String</td>
<td>Description of the error when an error occurred during the API call.</td>
</tr>
</tbody>
</table>

### 2.2.3 projects

An array with project information.

<table>
<thead>
<tr>
<th>Field name</th>
<th>Datatype</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>project_id</td>
<td>String (100)</td>
<td>File number of the project. A unique combination of numbers and/or letters and/or punctuation marks by which the file is identified</td>
</tr>
<tr>
<td>grant_id</td>
<td>String (100)</td>
<td></td>
</tr>
<tr>
<td>parent_project_id</td>
<td>String (100)</td>
<td>Programme, when there is a programme with underlying projects.</td>
</tr>
<tr>
<td>title</td>
<td>String (255)</td>
<td>Title of the project.</td>
</tr>
<tr>
<td>funding_scheme_id</td>
<td>String (50)</td>
<td>ID of the call under which the project falls.</td>
</tr>
<tr>
<td>funding_scheme</td>
<td>String (255)</td>
<td>Name of the call under which the project falls.</td>
</tr>
<tr>
<td>department</td>
<td>String (255)</td>
<td>NWO Domain under which the funding has been allocated to the project.</td>
</tr>
<tr>
<td>sub_department</td>
<td>String (255)</td>
<td>NWO Sub-domain under which the funding has been allocated to the project.</td>
</tr>
</tbody>
</table>
### Field name | Datatype | Definition
---|---|---
start_date | Date (YYYY-MM-DD) | Actual start date of the project.
end_date | Date (YYYY-MM-DD) | Actual completion date of the project.
summary_nl | String (8000) | Scientific summary of the project in Dutch.
summary_en | String (8000) | Scientific summary of the project in English.
summary_update | Array | Array details described in the next section, 2.2.3.1.
project_members | Array | Array with details of the project members. Details in section 0.
products | Array | Array with details of products orginated from the project. Details in section 0.

### 2.2.3.1 summary_update

As an array within the project information.

<table>
<thead>
<tr>
<th>Field name</th>
<th>Datatype</th>
<th>Omschrijving</th>
</tr>
</thead>
<tbody>
<tr>
<td>submission_date</td>
<td>Date (YYYY-MM-DD)</td>
<td>Date of submission summary update.</td>
</tr>
<tr>
<td>update_en</td>
<td>String (8000)</td>
<td>Update of the public summary of the project in Dutch. In the case de public summary is empty, the scientific summary will be returned.</td>
</tr>
<tr>
<td>update_nl</td>
<td>String (8000)</td>
<td>Update of the public summary of the project in English.</td>
</tr>
</tbody>
</table>

### 2.2.3.2 project_member

As an array within the project information.

<table>
<thead>
<tr>
<th>Field name</th>
<th>Datatype</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>role</td>
<td>String (255)</td>
<td>Role of the project member within the project. Possible returned roles are:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Main Applicant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Co-applicant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Project leader</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Researcher</td>
</tr>
<tr>
<td>member_id</td>
<td>Integer</td>
<td>ID for the project member.</td>
</tr>
<tr>
<td>orcid</td>
<td>String (255)</td>
<td>ORCID of the project member. Will become available as soon as NWO’s data is enriched with ORCID.</td>
</tr>
<tr>
<td>last_name</td>
<td>String (75)</td>
<td>Last name of the project member.</td>
</tr>
<tr>
<td>degree_pre_nominal</td>
<td>String (500)</td>
<td>Pre nominal titles.</td>
</tr>
<tr>
<td>degree_post_nominal</td>
<td>String (500)</td>
<td>Post nominal titles.</td>
</tr>
<tr>
<td>initials</td>
<td>String (16)</td>
<td>Initials of the project member.</td>
</tr>
<tr>
<td>first_name</td>
<td>String (75)</td>
<td>First name project member.</td>
</tr>
<tr>
<td>prefix</td>
<td>String (75)</td>
<td>Insert before the name.</td>
</tr>
</tbody>
</table>
### Field name | Datatype | Definition
---|---|---
daï | String (255) | Digital Author Identifier.
oorganisation | String (500) | Organization where the project member is working for the project.
oorganisation_id | Integer | Identifier for the organisation.
ror | String (255) | ROR-id of the organisation the project member is attending the project for. Will become available as soon as NWO’s data is enriched with ROR.
active | String (3) | Indication whether the project member is still working on the project.

### 2.2.3.3 product
As an array within the project information.

| Field name | Datatype | Definition |
---|---|---|
isbn | String (20) | ISBN of the product. |
doi | String (255) | DOI of the product. DOI will become available when NWO data is enriched with DOI’s. |
title | String (8000) | Title of publication. |
sub_title | String (8000) | Subtitle of the publication. |
year | Integer | Year of publication. |
city | String (50) | City of publication. |
start | Integer | Page in medium where the publication starts. |
end | Integer | Page in medium with the last page of the publication. |
type | String (50) | Type of the publication. |
url_open_access | String (1000) | Open access link to publication. |
publisher | String (255) | Publisher. |
journal_title | String (255) | Title of the journal of publication. |
authors | Array | An array with details of the authors of a product, described in the next section 2.2.3.3.1. |
2.2.3.1.3 authors

As an array within the product information.

<table>
<thead>
<tr>
<th>Field name</th>
<th>Datatype</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>last_name</td>
<td>String (75)</td>
<td>Last name of the project member.</td>
</tr>
<tr>
<td>degree_pre_nominal</td>
<td>String (500)</td>
<td>Pre nominal titles.</td>
</tr>
<tr>
<td>degree_post_nominal</td>
<td>String (500)</td>
<td>Post nominal titles.</td>
</tr>
<tr>
<td>initials</td>
<td>String (16)</td>
<td>Initials of the project member.</td>
</tr>
<tr>
<td>first_name</td>
<td>String (75)</td>
<td>First name project member.</td>
</tr>
<tr>
<td>prefix</td>
<td>String (75)</td>
<td>Insert before the name.</td>
</tr>
<tr>
<td>dai</td>
<td>String (255)</td>
<td>Digital Author Identifier.</td>
</tr>
</tbody>
</table>
3 Example API-Call

Input 1
The call below is an example that can be used for calling the API to get all the information available for the project with the project id VI.Veni.202.255.


Output 1
The message below is a sample JSON message that is returned based on the input of the example call.

```
{
  "meta": {
    "api_type": "NWO Projects API",
    "version": "1.0.0",
    "release_date": "2022-06-15T00:00:00",
    "funder": "501100003246",
    "project_id": "VI.Veni.202.255",
    "date": "2023-08-17T00:00:00",
    "count": 1,
    "per_page": 100,
    "pages": 1,
    "page": 1
  },
  "projects": [
    {
      "project_id": "VI.Veni.202.255",
      "title": "Modeling the Observable Signatures of Atmospheric Escape in Exoplanets",
      "funding_scheme_id": 4046,
      "funding_scheme": "NWO-Talentprogramma Veni ENW 2020",
      "department": "Exacte en Natuurwetenschappen",
      "sub_department": "Exacte en Natuurwetenschappen",
      "start_date": "2021-02-01T00:00:00",
      "summary_nl": "Characterizing the diversity of extrasolar planets (exoplanets) and assessing their potential for harboring life is one of the ultimate goals of the branch of astronomy dedicated to exoplanet studies. Whether a planet has a stable atmosphere is a key question, the answer to which depends on an interplay between a number of complex physical and chemical processes, including atmospheric escape. Atmospheric escape or mass loss can have a profound influence on the extent, composition, and evolution of a planetary atmosphere. Many aspects of this process, however, are still poorly understood, mostly due to a small number of direct observations of atmospheric escape in exoplanets that have been available until recently. In 2018, the spectral line of neutral helium at the wavelength of 1083 nm was discovered to be an excellent new diagnostic of upper layers of exoplanet atmospheres, where signatures of atmospheric escape can be studied. My previous work on theoretical modeling of escaping exoplanet atmospheres and their signatures at 1083 nm significantly contributed to establishing this new frontier in exoplanet characterization. As a Veni fellow, I will develop new 3D magnetohydrodynamic simulations of atmospheric escape in exoplanets and use them to generate synthetic observations (absorption spectra and transit light curves) in the helium 1083 nm line. I will compare the results of my simulations with high-resolution spectroscopic observations of three exoplanets with the strongest helium absorption signals recorded to date. This will allow me to constrain the physical properties of these atmospheres and infer their escape rates. This work will pave the way toward the development of empirically-based models of atmospheric mass loss and evolution, which are necessary for improving our understanding of planet formation and long-term stability and potential habitability of their atmospheres."
    }
  ]
}
astronomy dedicated to exoplanet studies. Whether a planet has a stable atmosphere is a key question, the answer to which depends on an interplay between a number of complex physical and chemical processes, including atmospheric escape. Atmospheric escape or mass loss can have a profound influence on the extent, composition, and evolution of a planetary atmosphere. Many aspects of this process, however, are still poorly understood, mostly due to a small number of direct observations of atmospheric escape in exoplanets that have been available until recently. In 2018, the spectral line of neutral helium at the wavelength of 1083 nm was discovered to be an excellent new diagnostic of upper layers of exoplanet atmospheres, where signatures of atmospheric escape can be studied. My previous work on theoretical modeling of escaping exoplanet atmospheres and their signatures at 1083 nm significantly contributed to establishing this new frontier in exoplanet characterization. As a Veni fellow, I will develop new 3D magnetohydrodynamic simulations of atmospheric escape in exoplanets and use them to generate synthetic observations (absorption spectra and transit light curves) in the helium 1083 nm line. I will compare the results of my simulations with high-resolution spectroscopic observations of three exoplanets with the strongest helium absorption signals recorded to date. This will allow me to constrain the physical properties of these atmospheres and infer their escape rates. This work will pave the way toward the development of empirically-based models of atmospheric mass loss and evolution, which are necessary for improving our understanding of planet formation and long-term stability and potential habitability of their atmospheres.

"project_members": [
{
  "role": "Project leader",
  "member_id": 441305,
  "last_name": "Oklopcic",
  "degree_pre_nominal": "dr.",
  "initials": "A.",
  "first_name": "Antonija",
  "organisation": "Harvard University",
  "organisation_id": 71717,
  "active": true
},
{
  "role": "Researcher",
  "member_id": 441305,
  "last_name": "Oklopcic",
  "degree_pre_nominal": "dr.",
  "initials": "A.",
  "first_name": "Antonija",
  "organisation": "Universiteit van Amsterdam||Faculteit der Natuurwetenschappen, Wiskunde en Informatica (Faculty of Science)||Anton Pannekoek Instituut voor Sterrenkunde",
  "organisation_id": 77831,
  "active": true
},
{
  "role": "Main Applicant",
  "member_id": 441305,
  "last_name": "Oklopcic",
  "degree_pre_nominal": "dr.",
  "initials": "A.",
  "first_name": "Antonija",
  "organisation": "Harvard University",
  "organisation_id": 71717,
  "active": true
}
],
"products": [}
The call below is an example that can be used for calling the API to get the information of projects from the “Technische Universiteit Delft” with a start date in the period 1-1-2024 until 1-3-2024.

https://nwopen-api.nwo.nl/NWOpen-API/api/Projects?Organisation="Technische Universiteit Delft"&rs_start_date=2024-01-01&re_start_date=2024-03-01&per_page=1
The message below is a sample JSON message that is returned based on the input of the example call.

```json
{
  "meta": {
    "api_type": "NWO Projects API",
    "version": "1.0.0",
    "release_date": "2022-06-15T00:00:00",
    "funder": "501100003246",
    "organisation": "Technische Universiteit Delft",
    "date": "2024-03-28T00:00:00",
    "count": 40,
    "per_page": 1,
    "pages": 40,
    "page": 1
  },
  "projects": [ {
    "project_id": "P21-30 project 3",
    "title": "3DNI – Innovative light-sheet microscopy for single-molecule localization microscopy in organoids",
    "funding_scheme_id": 4488,
    "funding_scheme": "Perspectief 2021-2022 TTW",
    "department": "Toegepaste en Technische Wetenschappen",
    "sub_department": "Toegepaste en Technische Wetenschappen",
    "start_date": "2024-02-15T00:00:00",
    "summary_nl": "-",
    "summary_en": "-",
    "project_members": [ {
      "role": "Project leader",
      "member_id": 376058,
      "last_name": "Smith",
      "degree_pre_nominal": "dr.",
      "initials": "C.S.",
      "first_name": "Carlas",
      "organisation": "Technische Universiteit Delft||Faculteit Mechanical Engineering (ME)"
    },
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}
```
The call below is an example that can be used for calling the API to get all information of projects with the word nanoparticles in the project title. The result will show a maximum of 10 projects in the result and will show the second page of the results.

https://nwopen-api.nwo.nl/NWOpen-API/api/Projects?title=%22nanoparticles%22&per_page=10&page=2

The message below is a sample JSON message that is returned based on the input of the example call.

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            "funding_scheme_id": 4851,
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            "summary_nl": "Endometriose is de meest frequente gynaecologische aandoening gekenmerkt door groei van weefsel uit de baarmoeder in de buikholte wat ernstige pijn en onvruchtbaarheid tot gevolg kan hebben. Ongeveer 10% van de vrouwen worden er door getroffen. Ondanks het verlies aan levenskwaliteit en een economische schade van milliarden euro’s alleen in Nederland, duurt het lang tot dat vrouwen gediagnosticeerd worden en beperkt de behandeling zich tot pijnstillers en hormonen. Wij gaan een RNA-gebaseerde therapie ontwikkelen, waarbij wij virussen nabootsen die cellen van het immuunsysteem bevallen, die diep het weefsel ingaan, om elwitten af te leveren om de ziekte efficiënt te behandelen."
        }
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  "organisation_id": 14387,
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  "initials": "J.",
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  "prefix": "van",
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  "organisation_id": 59105,
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  "initials": "W.P.R.",
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  "organisation": "Radboud Universitair Medisch Centrum||Department of Medical BioSciences",
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  "organisation": "Radboud Universiteit Nijmegen||Faculteit der Natuurwetenschappen, Wiskunde en Informatica||Subfaculteit Biologie||Moleculaire Biologie en Celbiologie",
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  "department": "Toegepaste en Technische Wetenschappen",
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"summary_nl": "Nanogeneeskunde wordt wereldwijd gebruikt om de behandelingen van verschillende ziekten te verbeteren, door gebruik te maken van nanodeeltjes voor de toediening van geneesmiddelen, medische beeldvorming en ziektediagnose. Een nieuwe methode zal worden toegepast om de beperkingen van de huidige meerstapssyntheseprocedures te overwinnen en een betere controle te bereiken over de samenstelling en morfologische kenmerken van nanodeeltjes die in biomedische toepassingen worden gebruikt. ",
"summary_en": "Nanomedicine is used worldwide to improve the treatments of various diseases, by employing nanoparticles for drug delivery, medical imaging, and disease diagnosis. A novel method will be applied to overcome the limitations of the current multi-step synthetic procedures and achieve a better control of the compositional and morphological features of nanoparticles used in biomedical applications. ",
"project_members": [
    {
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        "initials": "S.",
        "first_name": "Stefania",
        "organisation": "Universiteit van Amsterdam",
        "organisation_id": 44591,
        "active": true
    },
    {
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        "initials": "S.",
        "first_name": "Stefania",
        "organisation": "Universiteit van Amsterdam||Faculteit der Natuurwetenschappen, Wiskunde en Informatica (Faculty of Science)||Van 't Hoff Institute for Molecular Sciences (HIMS)"
    }
],
"project_id": "OCENW.M.22.066",
"title": "Optical 3D nm-resolved morphology monitoring of nanoparticles in action",
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"sub_department": "Exacte en Natuurwetenschappen",
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"summary_nl": "De fysische en chemische eigenschappen van metalen nanodeeltjes, belangrijk voor toepassingen van detectie tot katalyse en biogeneeskunde, zijn sterk afhankelijk van hun 3D-vorm. Aangezien deze vorm makkelijk kan veranderen tijdens het gebruik in verschillende toepassingen, hebben we nieuwe instrumenten nodig die de 3D-vormen van enkelvoudige metalen nanodeeltjes hierin met hoge verwerkingscapaciteit kunnen monitoren. Om dit doel te bereiken willen we de vormafhankelijke optische eigenschappen van metalen nanodeeltjes combineren met de uitstekende leercapaciteiten van artificiële neurale netwerken. De combinatie van simulaties, experimenten en machinaal leren maakt geheel nieuwe meetmodaliteiten mogelijk binnen het vakgebied van de nanomaterialen."

"summary_en": "The physical and chemical properties of metal nanoparticles, important for applications ranging from sensing to catalysis and biomedicine, are strongly dependent on their 3D shape. As the shape can easily change in realistic application environments, it is crucial to possess precise tools that monitor the shapes of single metal nanoparticles in such environments with high throughput. Here, we will connect the shape-dependent optical properties of metal nanoparticles with the excellent learning abilities of artificial neural networks to achieve that goal. This combination of simulations, experiments and machine learning enables completely new measurement modalities for a large range of nanomaterials' scientists."

"project_members": [
{
"role": "Project leader",
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"last_name": "Albrecht",
"degree_pre_nominal": "dr.",
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{
"role": "Researcher",
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}]}
The chemical industry relies heavily on carbon-based building blocks such as CO, methanol and other organic molecules. These molecules can be obtained via the reduction of atmospheric CO₂, an attractive approach to lower our dependency on fossil fuels and reduce global warming. Colourful, light-absorbing nanoparticles of coinage metals such as silver and copper can be used to steer the conversion of CO₂ towards specific desirable products. We will elucidate how these reactions can be activated and controlled with light, using advanced microscopy and spectroscopy techniques.

"project_members": [
{
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Nanoparticles show great potential for the treatment of disease. The encapsulation of therapeutic molecules into nanoparticles significantly improves their pharmacokinetics, biocompatibility, and biodistribution. The biggest challenge to date is the effective targeting of nanoparticles to specific disease sites, especially the brain. Indeed, nanoparticles need to overcome several obstacles from the moment of entering the blood circulation to the moment they reach the target site and release the drug. These obstacles include the evasion of clearance from the blood circulation, the passing of the blood-brain barrier and the entering of target brain cells. Tackling each of these obstacles demands distinct properties of the nanoparticles. A nanoparticle endowed with the ability to dynamically adapt its properties to meet all these demands does not exist, but would be a major breakthrough in the therapeutic applicability of nanoparticles.

A prominent property of nanoparticles that has been largely overlooked is ‘shape’. Indeed, nanoparticles generally adopt the energetically favorable spherical conformation, and to make non-spherical nanoparticles is technically challenging. Previous work suggests that non-spherical particles in the micrometer range are superior in evading clearance from the blood circulation, while spherical particles in the nanometer range are best to stimulate uptake by target cells. In this project I will design and generate novel nanoparticles that can shift from large and non-spherical to small and spherical shapes on demand, and apply these for the treatment of brain tumors. These shape-shifting nanoparticles are unprecedented and may reveal that in drug delivery size matters, but shape matters more.

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"project_members": [ 

  { 
    "role": "Main Applicant",
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    "last_name": "Zuhorn",
    "degree_pre_nominal": "prof. dr."
    "first_name": "Inge Susan",
    "organisation": "Universitair Medisch Centrum Groningen||BioMedical Engineering",
    "organisation_id": 78812,
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{
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Celtherapie heeft de afgelopen decennia belangrijke ontwikkelingen doorgemaakt bij de behandeling van schade als gevolg van hartinfarcten, ruggengraatletsel en kankerbehandeling en wordt sinds kort zelfs in Nederlandse ziekenhuizen gebruikt om patiënten te behandelen. Om de behandeling te optimaliseren en beter beschikbaar te maken, moeten er echter verschillende hindernissen nog worden overwonnen. Veel van de duur geprepareerde cellen voor therapie sterven op de plaats van injectie of kort daarna door gebrek aan zuurstof. Wij stellen voor nanodeeltjes (kleine, aanpasbare materialen) te gebruiken om zuurstof in cellen op te slaan en een overkoepelend probleem in veel therapeutische toepassingen op te lossen."

"summary_en": "Cell therapy has made significant developments in the past decades for treating damage from heart infarcts, spinal injuries, and cancer treatment and has recently even been used in Dutch clinics to treat patients. However, to optimise the treatment and make it more available, there are several hurdles to overcome. Many of the expensively prepared cells for therapy die at the injection site or shortly after due to a lack of oxygen. We propose the use of nanoparticles (tiny, customisable materials) to store oxygen in these cells and solve an overarching problem in many therapeutic applications."
Sustainable energy production relies on smart design of functional nanomaterials with controllable sizes and structures. Core-shell nanoparticles are highly functional materials with properties arising from the core or shell materials or a combination of both. Changing the electronic properties of the shell by tailored design or induced by the underlying core lead to enhanced catalytic performances, especially in electrocatalysis. Tailoring the structure and functions of core and shell materials simultaneously often involves complex chemical methods. In this KIEM GoChem project, University of Amsterdam will work together with VSParticle, Spark904 and Inholland University of Applied Sciences to develop a novel and environmentally friendly method for the gas-phase synthesis of core-shell nanoparticles. A physical process will be used to control the growth and the mean size of the core whilst the structure and thickness of the shell will be tuned via selective adsorption and thermal processes. Core-shell nanoparticles produced by the proposed method can be directly incorporated into the next process step, e.g. at electrode surface or in (conductive) composites.
Nano-sized particles have great potential in medicine as a system for drug delivery. Particles that only release their cargo in response to specific cues are especially promising. These could deliver drugs to distinct sites in the body, to cancer cells for example. In this project, we will investigate whether externally applied radiation, in the form of radiotherapy, could act as such a trigger to release drugs from nanoparticles. We will develop customized nanoparticles for this purpose and we will load them with model drugs. Radiotherapy will be applied, after which we will analyse whether the nanoparticles have released the drugs.

"project_members": [
    {
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      "organisation": "Rijksuniversiteit Groningen||Faculty of Science and Engineering (FSE)||Groningen Research Institute of Pharmacy||Farmaceutische Analyse",
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"title": "Synthesis and characterization of multifunctional SiO2-AG:Ce3+ phosphor core-shell nanoparticles for solid state lighting applications",
"funding_scheme_id": 3773,
"funding_scheme": "Bezoekersbeurs Bezoekersbeurs 2019 VW",
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Improving the efficiency and enhancing the colour uniformity of the LED-based products is one of the main goals of the lighting industry. Given that a significant share of worldwide energy consumption belongs to the lighting sector, any improvement in the performance and efficiency of LEDs will have a major positive implication for the society and the environment. This project aims at synthesizing SiO2-AG:Ce3+ phosphor core-shell structures in order to increase the mie-scattering of the light and to increase the efficiency of LEDs. This will also result in products of higher reliability and lifetime. When it comes to the mie-scattering, the surface structure of particles (in this case SiO2) and the uniformity of the shell thickness play a vital and prominent role. Particles with core-shell structure with narrow size distribution can be made by sol-gel method. Not much is known about the kinetics and growth mechanism of the shell layer on SiO2 particles, and how this can be controlled and manipulated during synthesis. Various approaches to control the surface structure of the nanoparticles are reported in the last years. Hung et al. synthesized mixed oxides by means of chemical vapour synthesis. By varying the mixing ratio of the oxides, the surface structure could be affected. Further studies, based on the use of various dopants, and the variation of composition of the gas phase are performed in order to produce structured surfaces. Besides gas phase-based synthesis, the synthesis in liquids is another approach, allowing the production of structured surfaces. For instance, Matsuda et al. used the hydrothermal reaction approach in order to synthesize mixed oxides. Moreover, sol-gel synthesis-based processes show great potential to produce particles with structured surfaces. In particular, the sol-gel reaction is usually conducted under much more moderate reaction conditions, compared to the hydrothermal approach. Here, the particle synthesis is typically conducted at ambient temperature and pressure. Varying the reaction conditions, the particle size can be controlled in the range between 20 and 2000 nm. This project aims at using sol-gel method in synthesizing SiO2-AG:Ce3+ phosphor core-shell structures. These particles can be used as scattering agents in LED lens. The phosphor has important optical functionality and therefore its thickness and its structure has significant influence on the performance and efficiency of LED systems. In this project the surface of the synthesized silica particles with size in the range of 20-50 nm will be coated with layers of YAG:Ce3+ phosphor by using properly adjusted ethanol/water mixture ratio by an optimized sol-gel process. The synthesis procedure is based on the sampling and heat-treating of reacting particle suspensions at 100°C, leading to secondary structures preferentially formed on the surface of particles. Particles with core-shell structures, synthesized with different conditions (i.e. different ethanol/water mixture ratio and different synthesis times), will be analyzed by different techniques. Synthesized powders will also be embedded in a polymeric matrix, which in this case is silicone, which is the base material for LED lens. Polymeric samples are discs of approximately 30 mm diameter and 1-3 mm thickness.
Improving the efficiency and enhancing the colour uniformity of the LED-based products is one of the main goals of the lighting industry. Given that a significant share of worldwide energy consumption belongs to the lighting sector, any improvement in the performance and efficiency of LEDs will have a major positive implication for the society and the environment. This project aims at synthesizing SiO2-AG:Ce3+ phosphor core-shell structures in order to increase the mie-scattering of the light and to increase the efficiency of LEDs. This will also result in products of higher reliability and lifetime. When it comes to the mie-scattering, the surface structure of particles (in this case SiO2) and the uniformity of the shell thickness play a vital and prominent role. Particles with core-shell structure with narrow size distribution can be made by sol-gel method. Not much is known about the kinetics and growth mechanism of the shell layer on SiO2 particles, and how this can be controlled and manipulated during synthesis. Various approaches to control the surface structure of the nanoparticles are reported in the last years. Hung et al. synthesized mixed oxides by means of chemical vapour synthesis. By varying the mixing ratio of the oxides, the surface structure could be affected. Further studies, based on the use of various dopants, and the variation of composition of the gas phase are performed in order to produce structured surfaces. Besides gas phase-based synthesis, the synthesis in liquids is another approach, allowing the production of structured surfaces. For instance, Matsuda et al. used the hydrothermal reaction approach in order to synthesize mixed oxides. Moreover, sol–gel synthesis-based processes show great potential to produce particles with structured surfaces. In particular, the sol–gel reaction is usually conducted under much more moderate reaction conditions, compared to the hydrothermal approach. Here, the particle synthesis is typically conducted at ambient temperature and pressure. Varying the reaction conditions, the particle size can be controlled in the range between 20 and 2000 nm. This project aims at using sol-gel method in synthesizing SiO2-AG:Ce3+ phosphor core-shell structures. These particles can be used as scattering agents in LED lens. The phosphor has important optical functionality and therefore its thickness and its structure has significant influence on the performance and efficiency of LED systems. In this project the surface of the synthesized silica particles with size in the range of 20-50 nm will be coated with layers of YAG:Ce3+ phosphor by using properly adjusted ethanol/water mixture ratio by an optimized sol-gel process. The synthesis procedure is based on the sampling and heat-treating of reacting particle suspensions at 100°C, leading to secondary structures preferentially formed on the surface of particles. Particles with core-shell structures, synthesized with different conditions (i.e. different ethanol/water mixture ratio and different synthesis times), will be analyzed by different techniques. Synthesized powders will also be embedded in a polymeric matrix, which in this case is silicone, which is the base material for LED lens. Polymeric samples are discs of approximately 30 mm diameter and 1-3 mm thickness.

"project_members": [
    {
        "role": "Main Applicant",
        "member_id": 183069,
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        "degree_pre_nominal": "prof. dr.",
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        "first_name": "Kouchi / GuoQi",
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        "organisation": "Technische Universiteit Delft||Faculteit Elektrotechniek, Wiskunde en Informatica||Microelectronics||Delfts Instituut voor Micro-Electronica en Submicrontechnologie"
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]
"member_id": 183069,
"last_name": "Zhang",
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"first_name": "Kouchi / GuoQi",
"organisation": "Technische Universiteit Delft||Faculteit Mechanical Engineering (ME)",
"organisation_id": 54530,
"active": true
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"project_id": "ENPPS.LIFT.019.002",
"title": "Development of designer bacterial nanoparticles for cancer immunotherapy",
"funding_scheme_id": 3804,
"funding_scheme": "ENW PPS Fonds LIFT 2019 juni 2019",
"department": "Exacte en Natuurwetenschappen",
"sub_department": "Exacte en Natuurwetenschappen",
"start_date": "2021-06-01T00:00:00",
"summary_nl": "We gebruiken specifieke determinanten van kankercellen (antigenen) om een kankervaccin te ontwerpen. We bestuderen de bijproducten van bacteriën die worden gebruikt om deze antigenen te produceren, zogenaamde eiwitlichamen (PB's), die grotendeels verkeerd gevouwen vormen van het tot overexpressie gebrachte recombinante eiwit bevatten. Deze PB's hebben de potentie om een sterke immuunrespons op te wekken en zijn daarom een potentiële kandidaat om als effectief vaccin te worden gebruikt. Wij ontwerpen deze kankervaccins door kanker-epitopen in het PB-platform op te nemen. Uit voorlopig werk blijkt dat deze therapeutische vaccins zeer effectief zijn in het uitroeien van de tumor. Het werkingsmechanisme wordt momenteel bestudeerd.",
"summary_en": "We use specific determinant of cancer cells (antigen) to design a cancer vaccin. We study the side products of bacteria that are used to produce these antigens, so called protein bodies (PBs), that contain largely misfolded forms of the overexpressed recombinant protein. These PBs have the potency to trigger a strong immune response and are therefore a potential candidate to be used as effective vaccine. We design these cancer vaccines by incorporating cancer epitopes in the PB platform. Preliminary work shows that these therapeutic vaccines are very effective in eradicating the tumor. Mechanism of action is currently studied.",
"project_members": [
{
"role": "Researcher",
"member_id": 492936,
"last_name": "Brekel",
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"first_name": "Thomas",
"prefix": "van den",
"organisation": "Amsterdam UMC - Locatie VUmc||Moleculaire Celbiologie en Immunologie",
"organisation_id": 77998,
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{
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"member_id": 183069,
"last_name": "Zhang",
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"initials": "G.Q.",
"first_name": "Kouchi / GuoQi",
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"degree_pre_nominal": "prof. dr.",
"initials": "Y.",
"first_name": "Yvette",
"prefix": "van",
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