SYNTHESIS OF ANISOTROPIC SILICON OBJECTS FOR OPTICALLY ACTIVE METAMATERIALS

Silicon has exceptional properties of interest to batteries, semi-conductors, electronics and optics. If it were possible to control the physical characteristics of silicon nano-objects, a host of possible applications would become possible in visible and near-infrared technologies due to the exceptionally high refractive index and low light absorption. Their assembly into a material would lead to metamaterials, materials with sub-wavelength dimensions displaying properties that are not observed in nature. Optical behavior in a metamaterial results from the composition and structural organization of a material. Metamaterials can shape an incoming or outgoing wavefront. Due to its low light absorption and high refractive index across the visible spectrum, crystalline silicon is the most desirable known material for optical metamaterials. Light is captured, concentrated and redirected by silicon particles thanks to a phenomenon called Mie resonance. This optical resonance within a particle is similar to how the sound of a plucked string is amplified via the acoustic resonance of a guitar.

The objective of this study is to create anisotropic shapes, silicon disks, rods and ovoids. A single object is thus able to support multiple dipole resonances, which is necessary for broadband optical manipulation. Bulk quantities of these sub-micrometric objects will be produced via both the bottom-up synthesis of silicon ovoids and disks and the metallothermic reduction of pre-formed silica. In the first case, either mechanical methods or surfactants will be used to induce anisotropy. In the metallothermic reduction method, the inherent porosity will need to be post-synthetically back-filled to obtain the desired optical resonances.

Once these silicon objects are realized, they will be processed into a material, using elastomer films and fibers. Films will be prepared via doctor-blading, spin-coating or dip-coating. Fibers will be spun using electrospinning. Obtaining high particle loadings within the polymer matrix will be the challenge. By stretching the elastomer matrix, particle alignment may be achieved parallel to the stretching direction to maximize optical response intensity. Broadband optical scattering is expected.

Candidate Profile
For this study, a chemist with synthetic experience is needed. Skills working under air-free conditions using a glove box and a Schlenck line and with pressurized systems are desired. Ideally, the candidate will have experience in several of the following characterization techniques: XRD, electron microscopy (TEM and SEM), porosimetry and optical spectroscopy. **A high level of scientific English, ambition and curiosity are required.**

Starting date, duration
The post doctorate researcher can start between January and June, 2021, for a duration of 24 months. The position will be kept open until filled.

Salary
~2 400 €/month (net) (subject to the candidate's level of experience)

Localization and Supervision
The post doctorate researcher will participate in the ERC funded project *Scatter* under the supervision of Dr. Glenna Drisko (https://glennadrisko.com/). She or he will be integrated into the *Chimie des Nanomatériaux* group (http://www.icmcb-bordeaux.cnrs.fr/spip.php?rubrique27) in the « Institut de Chimie de la Matière Condensée (ICMCB – CNRS UPR 9048) », in Bordeaux, France. The post doc will benefit from the synthetic experience of the host team as well as the material fabrication and optical characterization expertise in the project consortium. The post doctorate researcher will be responsible for the synthesis of silicon particles, particle assembly, optical characterization of both particles suspended in solution and assembled into a material. She or he will be directly involved in the work of 3 PhD students working on parallel and interconnected projects and will be working alongside 2 other post-docs in a highly dynamic and stimulating environment.

Application
The application will include a complete CV, a letter of motivation, and 2 of the candidate's publications. Letters of recommendation can be optionally included in a single PDF with the letter of motivation. The application should be written in English and **submitted through the CNRS website**. A first contact directly with Dr. Drisko is highly recommended (glenna.drisko@icmcb.cnrs.fr).