

Development of novel Carbon Nanotubes/SiOx composite protective coatings for solar cells

Summary

PhD study theme is focused on development of novel protective coatings based on nanocomposite materials. These coatings are aimed to protect solar cells and ought to show high optical transparency, provide effective radiative cooling of solar cells, protect them from UV, mechanical, and climatic impacts. Moreover, the materials and technologies developed during the project are expected to be promising for a broad variety of other applications. The main idea of the project is to improve the state-of-the-art SiOx protective coatings derived from polysilazane (PSZ) combining them with carbon nanomaterials: carbon nanotubes and graphene. In the framework of the project, we will employ a number of approaches to enhance protective properties of PSZ-based coatings. In particular, we are going to create novel PSZ-based composites with carbon nanomaterials and to apply various post-treatment techniques.

Research field:	Chemical, materials and energy technology
Supervisor:	Prof. Dr. Sergei Bereznev
Availability:	This position is available.
Offered by:	School of Engineering Department of Materials and Environmental Technology
Application deadline:	Applications are accepted between June 01, 2020 00:00 and July 03, 2020 23:59 (Europe/Zurich)

Description

The avoiding of cover glass for the protection of the solar panels is profitable in terms of mass, flexibility, costs and general compatibility in different areas. Numerous attempts to replace cover glass with other types of protection, mostly polymer-based coatings, have been made in the past, however, this task is not trivial as such coatings must on the one hand combine low thickness, good protective properties, and its technology must be low-temperature, reliable, scalable and relatively inexpensive. Recently the SiOx coatings fabricated from polysilazane (PSZ) solution were identified as a promising material to fit high requirements for PV protection. These "glass-like" coatings are also of particular interest for applications where corrosion and wearable resistance, hydrophobicity and self-cleaning properties are desired. A possible way for enforcing the mechanical stability of polymers (including PSZ-derived) with carbon nanotubes seems very promising. Moreover, it should be noted that optical and thermal properties of PSZ-derived carbon nanocomposites and resistivity of them to environmental and space influences has not been studied yet.

Responsibilities and tasks

According to the Project purposes, PhD student has different tasks related to deposition, characterization, modification of nanocomposite protection coatings and its application to the devices. Also, publication of obtained results in high-level profiling journals is very important task for PhD student. Finally, PhD thesis must be prepared according to timetable. Supervisor (assoc. prof. Sergei Bereznev) is responsible for coordination of PhD student's work and control of obtained results.

Qualifications

Master's degree with background knowledge of materials science and engineering, chemistry and physics.

The applicants should fulfill the following requirements:

- Special knowledge and skills connected with preparation and studies of the polymer and nanocomposite protective coatings are recommended.
- Appropriate background in polymers chemistry (chemical polymerization, photo-assisted polymerization, electro-chemical polymerization, spin-coating) is highly recommended.
- Experience connected with instrumental methods of characterization (UV-VIS-NIR and IR spectroscopy, Raman, XRD, etc.) and obtained data processing are important.
- Published scientific papers in above mentioned research area is also important positive factor for admission.



- Good knowledge of English language is required (enough for high quality oral presentation, teaching, supervising of students and writing of scientific papers).



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