VRIJE UNIVERSITEIT BRUSSEL

The faculty of Engineering of the Vrije Universiteit Brussel invites you to attend the public defense leading to the degree of

DOCTOR OF ENGINEERING SCIENCES

of **Dorothee Ehrhardt**

The public defense will take place on **Friday, 18th June 2021 at 4pm.**

To join the digital defense, please click here

REVERSIBLE COVALENT POLYMER LAYERS FOR SUSTAINABLE PERFORMANCE ENHANCEMENT OF PHOTOVOLTAICS

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Abstract of the PhD research

Conventional polymer coatings are prone to the formation of micro-cracks due to mechanical or thermal damages, limiting their long-term durability. In this PhD, self-healing polymer networks containing furan-maleimide Diels-Alder bonds are synthesized based on urethane-acrylate chemistry. Coatings with tunable mechanical properties are developed, which remain mechanically robust over a broad temperature range.

Selected materials are studied in terms of their capability to heal micro-cracks in order to restore functional properties. Here, also the role of hydrogen-bonding in the healing mechanism is explored. Self-healing is performed at temperatures below the material's glass transition temperature, i.e. in the (partially) vitrified state, where reaction rates are reduced due to mobility restrictions. This is very relevant in many applications, e.g. as self-healing protective coating in photovoltaics.

Photovoltaic modules are exposed to continuously changing operating temperatures, typically between -40 °C and 85 °C. During the colder seasons, however, the higher temperatures may not be reached for a longer period. Kinetic simulations are employed to evaluate the feasibility of self-healing at ambient temperature and as an indication of whether solar energy is sufficient as sole external trigger for thermally initiated self-healing. Finally, the suitability of selected self-healing polymers as protective coatings in photovoltaic modules is explored by relevant industrial testing.