Encapsulation and Stability of Perovskite Solar Cells for Underwater applications

Jessica BARICHELLO - *ISM-CNR*

In an always-connected world with an urgent need for clean energy, considering never-thinking solutions may help address the challenges of future cities. The untapped potential of underwater (UW) photovoltaic (PV) systems remain unexplored, but crucial for their integration with hydrogen production systems through solar-driven water splitting, especially if seawater or lake water are considered as an abundant source of fresh water. The Internet of Underwater Things (IoUT) is an emerging technology that has the potential to revolutionize the way we interact with the underwater world. As water depths increase, the higher-wavelength components of sunlight are absorbed, leaving predominantly blue-green light (400-600 nm) at depths of 10 meters and beyond. Recent theoretical analyses suggest that high-bandgap (2-2.2 eV) PV devices are ideal candidates for deep-UW applications, making them suitable for powering IoUT devices. Perovskite solar cells (PSCs) stand out as a promising technology with high-power conversion efficiency, tunable bandgap, and the unique characteristics of being colored and semi-transparent. This work first reports an innovative and industrially compatible encapsulation process based on laminating a highly viscoelastic semi-solid/highly viscous liquid encapsulant adhesive onto the PSCs1. Subsequently, we exploit this encapsulation technique in a pioneering experimental application of PSCs in an underwater environment. Following tests on the robustness of the PIB encapsulant in PSC devices, we investigated the sensitivity of the perovskite to a humid environment. This encapsulation not only enhances the durability of PSCs but also opens new possibilities for their use in diverse and challenging environments, including underwater systems for photoelectrocatalytic applications.