

Smart Passivation Materials with a Liquid Metal Microcapsule as Self-Healing Conductors for Sustainable and Flexible Devices

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The electrical repair of device circuits has been considered a main issue in the area of electronic packaging. Recently, diverse designs of self-healing and deformable circuits have been introduced in virtue of their high stretchability and conductivity. However, encapsulating a liquid metal with a polymer in a micro-size container is essential for real applications. In this talk, core-shell structured liquid metal microcapsules (LMCs) are synthesized via in situ polymerization of urea-formaldehyde onto liquid metal colloids. Passivation films comprising LMC/polymer composites are simply prepared using phase separation between the capsules and the liquid prepolymer. Capsules ruptured by cutting or pressing release and transport liquid metal to the damaged sites, leading to effective recovery of electrical pathways. As an example, flexible perovskite solar cells incorporated with the passivation film demonstrate perfect recovery of the photovoltaic parameters immediately after cutting the metal contact, exhibiting a power conversion efficiency (PCE) retention of 99% relative to the initial value (PCE=15.07%).