On the optical decharging of metal nanoparticles for hybrid nonvolatile memories applications

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As an emerging area in organic electronics, nonvolatile memories (NVMs) have become an active research topic in recent years, because they are likely to be an alternative or supplementary technology to the conventional memory devices. Among the different typology of NVMs, resistive switching devices (R-NVMs) are promising for their simple structure and easy processability. In the hybrid organic/inorganic NVMs (i.e. metal nanoparticles (M-NPs) embedded in organic layers), the switching between the high resistance state (OFF state) and the low resistance state (ON state) is often attributed to M-NPs charging/decharging.[1, 2] We investigated the fundamental physics behind the (light assisted) charging and decharging of M-NPs imbedded in a *p*-type organic semiconductor, using ultraviolet photoemission spectroscopy (UPS)[3] and electrical characterization (i.e. JV characteristic). We were able to explain the switching mechanism from the OFF state to ON state through a comparison of the electric and electronic properties of the hybrid interface. We conclude that optical addressability might be a novel approach to change the charge state of the metal NPs and could allow improving functionality and reducing writing time.

References

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[3] G. Ligorio, et al., Appl. Phys. Lett. **104**, 163302 (2014).