

Fluorescence-based paper sensors for the optical detection of nanomaterials

Evie L. PAPADOPOULOU, IIT

A paper sensor was designed in order to detect the presence of nanomaterials, like ZnO and silica nanoparticles, as well as graphene nanoplatelets, based on fluorescence changes of carbon nanodots. Paper strips were functionalized with carbon nanodots using polyvinyl alcohol (PVA) as binder. The carbon nanodots were highly fluorescent and hence rendered the cellulosic stripes emissive. In the presence of silica and ZnO nanoparticles the fluorescence emission of the carbon nanodots was quenched and the emission decay was shortened, whereas in the presence of GnP there was no change in the emission decay. The different PL quenching mechanisms that are evident from lifetime measurements convey selectivity to the sensor. The change in fluorescence of the carbon dot-functionalized paper is also evident to the naked eye under illumination with a UV lamp, which enables easy detection of the nanomaterials. The sensor was able to detect the nanomaterials either by dipping it in their aqueous dispersions, or by sweeping it over their powder. The use of the proposed optical sensor permits the detection of the nanomaterials in a straightforward manner, opening new ways for the development of optical sensors for practical applications.