Synthetic single-crystals are usually homogeneous solids. Biogenic single-crystals, however, can incorporate biomacromolecules and become inhomogeneous solid so that their properties are also extrinsically regulated by the incorporated materials. Here, Au, FeO, and QDs nanoparticles were incorporated, through a gel-grown crystallization method, into calcite single-crystals and, as a result, calcite single-crystals were turned into colored, paramagnetic fluorescent solids. Surprisingly, the stability and fluorescence lifetime of QDs were improved originating from the single-crystal host. As such, our work extends the long-history gel method for crystallization into a platform to functionalize single-crystalline materials to expand their potential application.

**Gel-grown Calcite Single-crystal**

**Nanoparticles inside Single-crystal Characterized by EM**

**Improved Stability and Fluorescence Lifetime of QDs inside Crystal**

**Single-crystal Positive Effect and Application in LED Device**

**Conclusions**

- The optical and magnetic functionalization are achieved through nanoparticle incorporation inside the calcite single-crystals.
- Gel growth media instead of solutions are necessary to induce the nanoparticle incorporations during which crystals incorporate the gel network and also the nanoparticles trapped in the gels.
- The improvement of stability and fluorescence lifetime of QDs is due to the nature of single-crystal, demonstrating benefits on nanoparticle from single-crystal host.

**References**