The nanodiamond doped tellurite fibers and cavities for single photon source and magnetometer

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Abstract

The negatively charged nitrogen-vacancy center (NV) is the most widely studied single optical defect in diamond and consists of a substitutional nitrogen atom adjacent to a carbon vacancy. Since the report of single NV spin initialisation and readout, the NV centre has become the most important solid-state, room-temperature compatible quantum platform. With long coherence time, fast microwave manipulation, and optical preparation and detection, the NV electronic spin can be used to store quantum information and realize logic gates. Spin dependent fluorescence intensity enables quantum sensing of magnetic and electric fields, temperature and quantum fluctuations. To utilize NVs in quantum applications, efficient and scalable optical coupling between NVs and photonic devices including waveguides and cavities is advantageous. In my talk, I will report our work to directly embed the nanodiamonds including NVs into tellurite fibers and sphere cavities. The ODMR (optically detected magnetic resonance) technique is being used to study the fibers' magnetic field response. For the nanodiamond embedded tellurite spheres, the whispering gallery mode modulated NV emission has been observed. By further decreasing the sphere size, and subsequent mode number, it is highly potential to significantly increase photon emission efficiency of the NVs for quantum and magnetometer applications. The explored doping processes can be easily extended to other types of the nanoparticles for diversified applications.

Biography

Dr Yinlan Ruan received her PhD degree from the Australian National University in 2006 with her study focusing on nonlinear chalcogenide waveguide devices. She joined Institute of Photonics and Advanced Sensing, University of Adelaide after PhD graduation. Since then, Dr Ruan has worked on five projects which include development of fluoride glasses for mid-IR laser transmission, microstructured fiber for bio-chemical sensing, graphene incorporated fibers for nonlinearity and biosensing, and nanodiamond doped tellurite fibers and sphere cavities for single photon sources and magnetometer. In her professional experience, Dr Ruan has gained research experience in transdisciplinary fields including physics, chemistry, materials and biology. Dr Ruan was the recipient of Chinese Government Award for Outstanding Self-funded Students Abroad (2005), Endeavor Australian Cheung Kong Award (2005) and Australian Postdoctoral Fellow (2008).