

Chiral Acoustics with NV Centers in Diamond

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Strong confinement of electromagnetic waves transverse to the direction of propagation, such as fast-decaying evanescent electromagnetic waves, can lead to propagation-direction-dependent light matter interactions. These chiral optical processes have been explored extensively in interactions of quantum dots and cold atoms with optical fields in waveguides and whispery optical resonators[1]. The chiral interactions are not unique to optical processes. For example, chiral interactions can be pursued with surface acoustic waves in a crystal, which decay exponentially away from the crystal surface. In this paper, we present experimental studies on the chiral acoustic or strain coupling between surface acoustic waves and negatively-charged nitrogen vacancy (NV) centers in diamond. The surface acoustic waves are generated with interdigital transducers patterned on a piezoelectric ZnO layer sputtered on the surface of diamond (see Fig. 1). We will discuss and analyze propagation-direction-dependent acoustic absorption in a dense ensemble of NV centers.

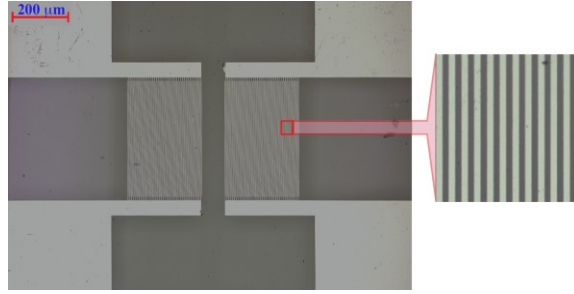


FIG. 1 Optical image of a pair of interdigital transducers fabricated on the diamond surface.

References:

- [1] P. Lodahl, S. Mahmoodian, S. Stobbe, A. Rauschenbeutel, P. Schneeweiss, J. Volz, H. Pichler, and P. Zoller, *Chiral quantum optics*, Nature **541** (2017).