Intensity modulations of the probe transmission by pumping 1S-exciton

S. Siegeroth[1*], B. Panda[1], M. Harati[1], J. Heckötter[1], M. Aßmann[1]

[1]*Faculty of Physics, TU Dortmund University, Otto Hahn Straße 4, Dortmund, Germany..*
**E-Mail: simon.siegeroth@tu-dortmund.de*

Using a two-color pump probe setup, we see intensity modulations of the probe beam. The pump excites 1S-excitons. The modulations appear as a function of the pump laser energy and only when we use a special cavity (Fig. 1). The (bad) cavity consists of two glass plates with a reflectivity of about 4% at each surface. The sample is Cu_2O (~50 µm) and is mounted strain-free between the glass plates inside a capton layer (~ 75 µm). ITO (~115 nm) is vaporized on the inside of the glass plates for electric field measurements (not used here). The sample is cooled to 1.3 K in a bath cryostat.
The origin of the modulations (oscillations) is not clear and physical parameters are investigated with different measurements. The modulations (= relative phase shift of 2π) increase with increasing pump power (Fig. 2). The probe is in resonance with the 10P-exciton. If the probe energy is tuned out of resonance or even below the 1S-exciton resonance, where no phonons exist, the relative phase shift of 2π remains constant. The probe energy does not directly change the modulations. However, when the pump power is varied for two different probe energies, the scaling of the oscillations in respect to the pump power is different. The modulations can also be seen in the reflected beam of the probe beam. The reflected and transmitted beams have a phase shift of π. For different angles of incidence of the probe beam the number of relative phase shifts of 2π stays constant but the relative phase between the measurements is different.

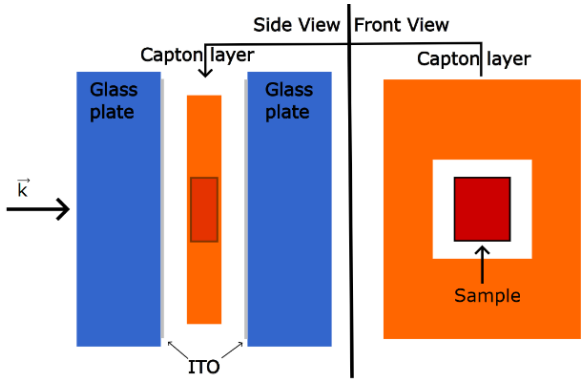

Fig. 1. Special Holder: Two 50 mm thick Glass plates

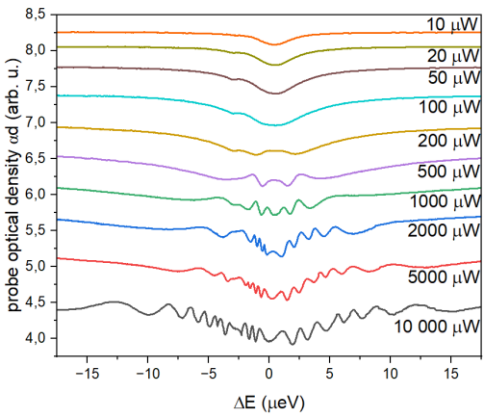

Fig. 2. Probe OD for different pump powers

We moved the probe so that it did not overlap with the pump around the sample. Even millimeters away from the pump beam modulations appear. It is important to note that there are no modulations without the cavity.

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