Photoinduced magnetization dynamics in a THz emitter based on a spin valve

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A spin valve is a structure with the injection of spin between ferromagnetic layers through a non-magnetic metal highly dependent on the relative orientation of the magnetization in those layers. This property can be used to generate the THz range.

The experiment was carried out using two techniques: pump-probe in reflection geometry and THz time-resolved spectroscopy (THz-TDS) in transmission geometry. During the experiment, the terahertz and magneto-optical response were simultaneously recorded. This makes it possible to observe the connection between excitation of magnetization and THz emission induced by transverse spin currents.

The samples were spin valve-type structures: TCFC/Cu/TCFC and Ru/TCFC/Cu/TCFC on Si substrates. Here TCFC is $TbCo_2$/FeCo. The Ru cover layer made it possible to reduce the coercive field of the magnetically hard layer, which is confirmed by the TMOKE curves. The direction of magnetization was controlled by applying a magnetic field in the plane of the sample.

During the experiment, the time dependencies of the THz amplitude and the photoinduced response were obtained when applying a magnetic field of various magnitudes: ± 0.9, ± 2.6 and ± 6.6 kOe. The behavior of magnetization at various moments of photoinduced relaxation was characterized using dynamic hysteresis loops.

The work is supported by the Ministry of Science and Higher Education of the Russian Federation (project No. 075-15-2022-1131).