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Time-domain measurement of spin-Seebeck effect as a function of temperature: interface magnon effect ZIHAO YANG, Department of Electrical and Computer Engineering, The Ohio State University, Columbus, Ohio, USA, JOHN JAMISON, Department of Material Science and Engineering, The Ohio State University, Columbus, Ohio, USA, ROBERTO MYERS, Department of Electrical and Computer Engineering, The Ohio State University, Columbus, Ohio, USA — Time-resolved longitudinal spin Seebeck effect (LSSE) measurements allow a means to separate the influence of thermally excited electrons, phonons and magnons on the detected spin current. In this study, we measured the time dependence of the LSSE signal in Pt/YIG structures using a high bandwidth oscilloscope and a modulated CW laser from 20 K to 300 K. The rise of the LSSE signal is sharp and not truncated indicating that the measurement is not limited by the bandwidth of the setup. The temporal profile of the LSSE signal consists of two distinct components, a fast rise (200 ns) and a slow rise. The fast component is temperature independent and roughly on par with the rise time of the modulated laser intensity, while the slow component does not saturate upto 50 μs. We model the temporal evolution of the LSSE signal by carrying out three-temperature 3D time domain heat diffusion finite element modeling of the magnon temperature gradient profile in YIG to determine the electron, magnon, and phonon temperature profile versus time. It is found that the magnon temperature gradient near the YIG interface exhibits the same fast rise time that is measured in the LSSE signal. We discuss implications for this measurement on the existing models of LSSE.

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