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Nontrivial Topological Surface States in SmB_6 Thin Films TAO LIU, Colorado State University, YUFAN LI, Johns Hopkins University, LEI GU, University of California, Irvine, JUNJIA DING, Argonne National Laboratory, HOUCHEN CHANG, P. A. PRAVEEN JANANTHA, Colorado State University, BORIS KALINIKOS, St. Petersburg Electrotechnical University, VALENTYN NOVOSAD, AXEL HOFFMANN, Argonne National Laboratory, RUQIAN WU, University of California, Irvine, CHIA-LING CHIEN, Johns Hopkins University, MINGZHONG WU, Colorado State University — Being identified as the first rare earth mixed valence system and the first Kondo insulator, SmB_6 may very likely be the first topological Kondo insulator as well. Recent studies, theoretical and experimental, have suggested the existence of metallic surface states in single-crystal SmB_6 bulk materials, but the presumed topologically nontrivial nature and spatial scale of the surface states, as well as many other aspects, remain outstanding. This work demonstrates the nontrivial topological nature of the surface states in SmB_6 thin films via a spin pumping technique with samples of SmB_6 thin films grown on $Y_3Fe_5O_{12}$ (YIG) slabs. In samples where the SmB_6 film thickness (d) is 80 nm or larger, the spin-pumping voltage signal becomes much stronger as the temperature (T) decreases from 150 K to 10 K. Such an enhancement originates from spin-momentum locking of the metallic surface states, thereby providing strong evidence for the nontrivial topological nature of the surface states. The results also suggest a thickness of about 32 nm for the topological surface state, which was confirmed by T-dependent transport measurements and theoretical analysis using the tight binding model.

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