An Innovative Approach to Improve Spin Polarization in Co2FeAl0.5Si0.5 Thin Films for Spin Transport Electronics

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The utilization of half-metallic ferromagnets (HMF's) has been proposed as an ideal method of producing spintronic devices, such as magnetic random access memory and magnetoresistive read head devices. HMF based Magnetic Tunnel Junctions (MTJs), which would be utilized for next generation electronics, can theoretically lead to infinitely large tunneling magnetoresistance (TMR) and up to 100% spin polarization. Among existing HMF's Co2FeAl0.5Si0.5 (CFAS) exhibits strong spin-polarization as the Fermi Level lies between band gaps of minority carriers. CFAS films were sputtered on thermally oxidized Si and MgO substrates in growth temperatures ranging from room temperature to 600°C. To ensure high quality of thin films, electrical and structural characterization was done using a 4–point probe and Rutherford Backscattering Spectroscopy (RBS) respectively. CFAS/AlOx/Pb devices were fabricated by synthesizing AlOx as a barrier and Pb as the top electrode in a physical vapor deposition (PVD) system. Low temperature electrical measurements (up to 4.2K) were conducted. Mathematical modeling of the data indicated high spin-polarization values obtained by optimizing interfacial strain and growth temperatures.

Awards Won:

Intel ISEF Best of Category Award of $5,000

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