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Low Damping in Spinel Ferrite Thin Films Enabled by Chemical Substitution[1] SATORU EMORI, MATTHEW GRAY, SAMUEL CROSSLEY, URUSA ALAAN, ADRIAN SWARTZ, Stanford University, BENJAMIN GRAY, Air Force Research Laboratory, HYUNG-MIN JEON, Wright State University, HAROLD HWANG, Stanford University, BRANDON HOWE, Air Force Research Laboratory, YURI SUZUKI, Stanford University — Spinel ferrites are versatile magnetic insulators whose properties can be tuned by chemical substitution of their constituent elements. However, it has been a challenge to realize spinel ferrite thin films with sufficiently low damping for emerging spintronic applications. We achieve low damping in spinel ferrite films by substituting a large fraction of Fe with Al. Films of thickness ≈25 nm and nominal compositions $Ni_{0.65}Zn_{0.35}Al_xFe_{2-x}O_4$ are grown on single-crystal $MgAl_2O_4(001)$ substrates by pulsed laser deposition. Fully coherent growth of Ni-Zn ferrite (x=0) on $MgAl_2O_4$ is elusive due to the large substrate-film lattice mismatch of >3%. High concentrations of Al ($x \geq 0.5$) decrease the lattice constant of the ferrite such that the films are fully strained to the substrate and highly crystalline. As the Al concentration is increased from x=0.5 to 1.0, the Gilbert damping parameter α is reduced from ≈0.02 to ≈0.005, lower than α of permalloy. These low-damping spinel ferrite thin films facilitate the development of new spintronic devices based on insulating oxides.

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