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Understanding Magnetic Frustration on the Diamond Lattice of Transition Metal Oxide Spinels BRENT MELOT, KATHARINE PAGE, RAM SESHADRI, Materials Department, University of California, Santa Barbara, CA, 93106–5050 USA, DORON BERGMAN, Physics Department, University of California, Santa Barbara, CA, 93106–9530 USA, THOMAS PROFFEN, Manuel Lujan, Jr. Neutron Scattering Center, Los Alamos National Laboratory, LANSCE-12, MS H805, Los Alamos, New Mexico 87545, USA — We present structural and magnetic measurements on the solid solution $CoAl_{2-x}Ga_xO_4$ and demonstrate how frustration on the diamond sublattice can be modified through chemical substitution. The effect of substitution is two-fold. Increasing values of x are accompanied by an increase in the lattice parameter resulting in an elongated and consequentially weakened exchange pathway. Our data indicates that the amount of site mixing also increases across the substitution series weakening the A-O-B-O-A superexchange pathway. Monte Carlo simulations were used to compute the exchange coupling constants between nearest and next-nearest neighbor Co atoms. Density functional calculations were also performed to approximate the nearest neighbor coupling constant. For most values of x, we find that the frustration parameter, Θ_{CW}/T_N, decreases which we attribute to the weakening competition between nearest and next-nearest-neighbor Co exchange interactions.

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