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A Mössbauer study of ruthenium oxide-hematite nanostructures
CHRISTOPHER STROH, MONICA SORESCU, Duquesne University — Ruthenium oxide-doped hematite, xRuO_2(1-x)α-Fe_2O_3 (x = 0.1 - 0.7) solid solutions were synthesized using ball milling. Samples were taken at 0, 2, 4, 8, and 12 hours ball milling time (BMT). NORMOS-90 software was utilized to identify parameters for the Mössbauer spectra of the samples using least-squares fitting. At 0 hours BMT, all concentrations displayed only one sextet. As the BMT increased, the sample of x = 0.1 displayed two sextets at 2 hours, and three sextets for all subsequent times. This correlates well with the substitution of Ru for Fe in the hematite lattice. In increased concentrations, quadrupole-split doublets appeared and the number of sextets increased with BMT. As the BMT increased, the abundance of the quadrupole split doublets increased as well, indicating that the replacement of Ru^{4+} with Fe^{3+} increased in the RuO_2 lattice. The most apparent example of this is in the x = 0.7 sample, at 2 hours BMT the abundance of the doublet is 5.251%, however at 12 hours BMT the abundance reaches 52.678%. The quadrupole-split doublets also increased in abundance as the concentration of the sample was increased. The findings of this research show the reality of creating nanoparticle solid solutions by mechanical means.

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