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Investigation of Local Structures and Magnetism in Mn-doped Y_2O_3 Nanocrystals[1] T.S. WU, S.L. CHANG, Y.L. SOO, National Tsing Hua University — Nanocrystals of Mn-doped Y_2O_3 were prepared by thermal decomposition method and alternately annealed in oxygen and forming gas to vary the oxygen deficiency. X-ray diffraction (XRD), high-resolution transmission electron microscopy (HR-TEM), x-ray absorption fine structures (XAFS), and superconducting quantum interference device (SQUID) techniques were applied before and after each annealing to monitor structural and magnetic variations of the sample. The XRD data show that these annealing treatments do not appreciably change the average particle size of the sample. An amorphous-to-crystalline long-range-order structural change was observed for the first annealing applied to the as-made samples. The short-range-order structure exhibited by XAFS reveals that O vacancies surrounding magnetic impurity atoms were appreciably increased by forming-gas-annealing and decreased by oxygen-annealing in the samples. The increase and decrease of O vacancies are accompanied by enhanced and reduced saturation magnetization as demonstrated by SQUID, respectively. Our experimental results demonstrate clear correlation between magnetism and O vacancies around magnetic ions and therefore strongly support the bound magnetic polaron model in these nanocrystal DMO samples.

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