Electron paramagnetic resonance spectra of natural spinel $MgAl_2O_4$ doped with Me^{3+} (Me=Cr^{3+}, Fe^{3+}) ions

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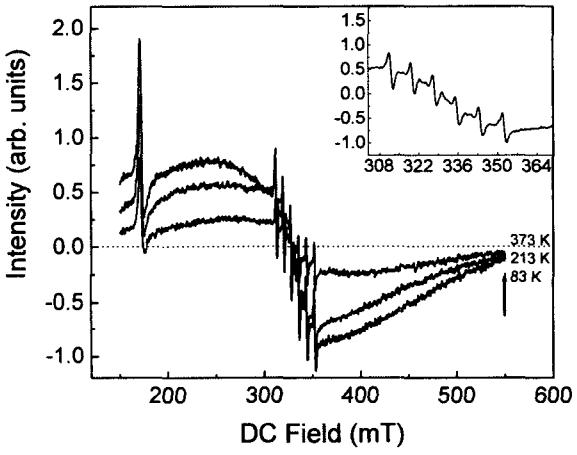
This work presents a study of electron paramagnetic resonance (EPR) of natural spinel $MgAl_2O_4$ doped with Cr^{3+} ions and that doped with both Cr^{3+} and Fe^{3+} ions. The EPR spectrum of the former compound appears an asymmetrical resonant region at 170 mT, due to influences of the octahedral and tetrahedral fields on the spin-spin interaction of the Cr^{3+} ion [1-2], and this resonant region is stable with respect to the temperature range investigated between 83 and 473 K. The next broadband appeares at 335 mT is due to the spin interaction with the host lattice, defects and the doping in the crystal. This feature is experimentally verified by taking account of the EPR spectra of the latter compound doped with Cr^{3+} and Fe^{3+} ions (see Figure). The influence of Fe-doping on the noted broadband at 335 mT was found (see the inset), but it did not affect the statement of the resonant region at 170 mT, suggesting that the role of the Fe-doping to the optical property of the Cr^{3+} doped $MgAl_2O_4$ natural spinel is negligible in the absence of an external magnetic field. The average peak-to-peak linewidth of resonant lines is ~5 mT, and the Lande's factor g was estimated to be ~2.01. In terms of the obtained results, we strongly propose that the EPR study is a helpful tool for evaluations of the influence of the Fe-doping on the physical properties of the Cr^{3+} doped $MgAl_2O_4$ natural spinel.



References

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