Decoration of NaCl Crystals Using Blue Coloration with Electron Irradiation

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We found that blue coloration is produced by electon irradiation above about 100 ℃ in NaCl crystals and the coloration is very sensitive to the presence of some kind of impurities. In this investigation we introduced manganese ions into the NaCl crystals by the Kyropoulos method and decorated the cleaved surfaces with this blue coloration. The as-grown crystals showed the complex pattern decorated with the blue coloration. The sub-grain boundaries were decorated as the thick dark lines. The Electron-Spin-Resonance spectra(ESR spectra) showed that a large part of manganese ions were in the form of aggregated Mn ions, perhaps, in the form of $MnCl_2$ molecules. Therefore, the decorated thick dark lines are due to the sensitization by the selectively precipitated $MnCl_2$ molecules at the sub-grain boundries.

On the other hand, the qenched NaCl-Mn crystals showed almost homogeneous blue coloration by electron irradiation. Only sub-grain boudaries were decorated as the thin dark lines. The analysis of the ESR spectra showed that the manganese ions were dispersed in the crystal in the form of isolated lattice ions associated with positive ion vacancies. Therefore the observed thin dark lines at the sub-grain boundaries may be decorated by the sensitization effect of the structural imperfection of the crystal lattice.