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Precise lattice parameter measurements in CsCl-Br solid solutions between room temperature and 90°K by powder x-ray diffraction*

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Abstract. Solid solutions of CsCl-Br in five different concentrations were prepared in sealed quartz tubes by heating the mixture to 1123°K for 6–8 hr and quenching to room temperature. X-ray diffractograms were taken at eight different temperatures between room temperature and 90°K for these solid solutions using the YPC50NM powder diffractometer and a continuous flow cryostat. The observed lattice parameters for each sample at each temperature obtained from the powder diffractograms were then extrapolated to give the true lattice parameters using the least square method with Nelson-Riley extrapolation scheme. The values of the true lattice parameters at each concentration and at each temperature were tabulated and the results discussed. It is shown that the lattice parameters vs temperature for some concentrations exhibit an anomalous behaviour.

Keywords. Solid solutions; continuous flow cryostat; true lattice parameters; Nelson-Riley extrapolation scheme.

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1. Introduction

Study of mechanical, electrical and thermal properties of solid solutions is very important in solid state physics and in the recent past a number of people have started work in this area (Shukla *et al* 1976; Natarajan *et al* 1970; and Beg and Kobbelt 1982). In some of these solid solutions of alkali halides it has even become possible to grow single crystals for inelastic neutron scattering work to measure phonon dispersion relations (Beg and Kobbelt 1982). Shukla *et al* (1976) and Natarajan *et al* (1970) have claimed good success in forming solid solutions other than KCl-KBr systems. They were able to prove that CsCl forms good solid solutions with other alkali halides and crystallize in Pm3m structure and retain the structure throughout the concentration range in which the salts were mixed. They substantiated their results in the case of CsCl based solid solutions by heat of solution and heat of mixing measurements and by testing the homogeneity of the samples by x-ray lattice parameter measurements. Hence it was considered worthwhile to take CsCl-Br system as a case study in order to (i) obtain the lattice parameter shifts as a function of concentration and as a function of temperature and (ii) look how the lattice parameter behaves for each concentration at low temperatures down to 90°K as there is no experimental data available for these salts in this temperature range.

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