said diffraction plane being defined by said incident beam and a diffracted beam, said rotation for variation of the beam/specimen orientation;

c) Movement of said detector within said diffraction plane, to receive the diffracted beam and create a signal;

d) Storage of said signals emitted by said photon or particle detector of said measured reflection factor as a function of an angle of rotation of the specimen around said first axis;

e) Integration of said measurements over said angle of rotation for the determination of the integral reflection factor R_{int};

f) Variation of an effective thickness of the specimen by pivoting the specimen around a second axis at an angle, said second axis being perpendicular to said lattice planes, with repetition of the operations indicated in a) to e);

g) Determination and storage of said integral reflection factor for a number j of settings of said pivot angle as a series of measurements R_{int}^{j} as a function of said effective thickness of the specimen; and

h) Determination of the first static Debye-Waller factor (E_{220}) by fitting to a specified theoretical function, in said function, with E as a parameter, said integral reflection factor is calculated as a function of said thickness of the specimen, in the sequence of the recorded measurements of R_{int}^{j};

B) Performance of at least one additional series of measurements, in said series of measurements steps A) 1) a) to A) 1) h) are repeated as A) 1+n) a) to A) 1+n) h) with another diffraction order, and at least one additional Debye-Waller factor (E_{440}, . . .) being determined; and

C) Evaluation of the investigations performed in the individual series A) to B) with the static Debye-Waller factor as a function of said diffraction order to determine the density and the average extent of precipitated impurities in said area of the specimen.

10. The process of claim **9**, further comprising:

D) Inspection of at least one additional discrete crystal area of the specimen, by repetition of steps A) to C) on the specimen to determine ; and

E) Mapping of the density and average extent of precipitated impurities in the crystal lattice of the monocrystalline material for said discrete areas.

11. The process of claim **10**, wherein said radiation beam comprises X-ray radiation in the wavelength range of about 0.02 nm to 0.003 nm is used, corresponding to photon energies of about 50 keV to 450 keV.

12. The process of claim **10**, wherein said radiation comprises synchrotron radiation, and said detector comprises a detector for energy dispersive detection of the dispersed radiation.

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