Theory of Dynamical Effects in Diffuse Scattering

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Diffuse scattering is a well-known and very useful tool to investigate short range order (SRO) as well as displacement fields in alloys. Up to now, quantitative experiments use scattering by X rays and neutrons. To analyze the experiments a simple first order Born approximation (or kinematic theory) is then generally sufficient. The case of electrons, as those used in an electron microscope, is different. Because of their strong interaction with matter, multiple scattering of electrons cannot be neglected and a full dynamical theory has to be used. Such a theory has been implemented for a fairly long time to simulate diffraction or images in the case of perfect crystals, but the corresponding codes cannot be used easily for diffuse scattering. We have developed a simple model based on ideas by Van Dyck *et al.* which predicts that, actually, dynamical effects are not very important when interested in SRO-induced diffuse scattering. This explains well recent experimental observations on CuPd by Ikematsu *et al.* and shows that modern microscopes with energy filters and numerical recording systems can provide quantitative informations related to the diffuse intensity.