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Calculation of Parametric X-ray Radiation Distribution from a Textured Polycrystal and an Approach to Orientation Distribution Function Reconstruction

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The parametric X-ray radiation (PXR) by relativistic charged particles in polycrystals was considered in a number of theoretical and experimental investigations during the past two decades. However, in most cases the texture properties of polycrystals was either neglected (uniform distribution of crystallites was assumed) or described semi-qualitatively by preferred orientation and misorientation angle. The actual texture of many promising radiation targets, e.g. nanodiamond films, requires a more extended qualitative description in terms of Orientation Distribution Function (ODF).

In the present contribution we consider spectral and angular distribution of PXR accounting for ODF of the polycrystal. It is shown that at least two texture models result in analytical solutions for the intensity distribution, they are: fiber texture model and peak component texture model.

Using the characteristics of real specimen of polycrystalline nanodiamond film and parameters of existing electron accelerators we make estimations of a number of emitted photons. The numerical comparison of PXR in monocrystals and polycrystals is discussed.

As one of the possible applications, the inverse problem of ODF determination from PXR data is considered. It is proven that under certain assumptions ODF is completely determined through the intensity distribution.

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