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Parametric X-ray radiation from powders with different grain size

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Parametric X-ray radiation (PXR) appears during coherent scattering of the charged particle Coulomb field on the atomic structures. PXR was studied theoretically and experimentally in different geometries, in a wide range of charged particles energies and different targets (crystalline, polycrystalline and multilayer mirrors). Nevertheless, the PXR from powders is one of sufficient lacuna for considered radiation.

The presented study is devoted to the PXR research in powders with different grain size. The results were compared with the diffraction of wideband X-rays (XRD) on the same targets. The PXR is observed under interaction of a

7 MeV electron beam with diamond powders with grain sizes in the ranges 60-70 μm , 6-7 μm and 200-300 nm. The PXR photons are detected with two spectrometry channels at observation angles 150° and 180° relative to the direction of incident electrons propagation. The primary X-ray beam was generated by an X-ray tube with tungsten anode and the XRD photons are detected at an observation angle of 150°.

The PXR and XRD spectral peaks corresponding to the crystallographic planes (111) and (220) were detected for all the targets and their yields are compared relatively to the values of grain size. The obtained results demonstrate differences in diffraction processes of real and virtual photons. The possibility of PXR application for atomic structure diagnostics is discussed.

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