Nondestructive Observation of Crystalline Phase Distribution with Confocal Angle-Dispersive X-ray Diffractometer

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Natural and industrial materials, which have a variety of functions and characteristics, mostly have complicated structures. They do not comprise a single phase but are inhomogeneous and exhibit unique properties attributed to the textures. Consequently, characterizations of the samples, considering their particular inhomogeneities, are important.

X-ray diffraction measurements from minizones were tested using a confocal arrangement of polycapillary focusing optics. Diffraction was measured by scanning the angle of the polycapillary focusing optics receiving the diffracted X-rays while maintaining the confocal point with the polycapillary of the incident X-rays. When the inside of a sample consisting of two or more substances was scanned, the crystalline material could be identified from the X-ray diffraction pattern at the focal point. It was also possible to obtain the spatial distributions of crystals in a polycrystalline sample that otherwise appeared homogeneous at a macroscopic level. Particularly, differences in the packing density of crystals within a sample could be observed. Though the beam constructed via the polycapillary optics had a large angular divergence at the focal point and the angular resolution of the obtained diffraction pattern was low, the spatial distribution analysis of the crystal phases in inhomogeneous samples was possible.

References

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