

Texture analysis of pyrolytic carbon by polarized light microscopy and selected area electron diffraction: A quantitative model for the correlation between extinction angle and orientation angle

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Many properties of pyrolytic carbon depend strongly on the degree of texture which is frequently analyzed by polarized light microscopy (PLM) and selected area electron diffraction (SAED). PLM allows the fast and simple determination of the extinction angle A_e . SAED exhibits a higher spatial resolution which is mainly determined by the diameter of the SAED aperture and allows the determination of the orientation angle.

A quantitative model for the relationship between the extinction angle determined by PLM and the orientation angle determined by SAED is presented and applied to our experimental data [1, 2]. The distribution of the orientation of coherent domains is derived from SAED data and the reflection coefficients of pyrolytic carbon are calculated as the sum of the reflection coefficients of the coherent domains. The only fit parameters in this model are the ratio of the reflection coefficients of the coherent domains for extraordinary and ordinary rays r_e/r_o and the relative phase shift Δ . A good agreement between calculation and experiment is achieved for a r_e/r_o of 0.33 and a phase shift $|\Delta|$ of 75°. The results allow a quantitative comparison of extinction angles with orientation angles and suggest a larger phase shift for the coherent domains than reported for graphite in literature.

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