

THE CARBON FIBERS X-RAY EMISSION $CK\alpha$ —SPECTRA PECULIARITIES

Zaulichny Ya., Solonin Yu., Zvezda S.

Frantsevich Institute for the Problem of Materials Science of NAS of Ukraine
Krzhyzhanovsky str., 3, Kyiv, 03680, Ukraine

Introduction

The electronic states energy distribution in carbon fibers (base polyacrylonitril) with different thickness under different orientation to irradiation selection direction was studied by means of the ultrasoft X-ray emission spectroscopy.

Results and discussion

The $CK\alpha$ -emission bands shape dependence on their orientation to irradiation selection direction was elucidated. The $CK\alpha$ maximum reflected π -states in fibers oriented so that p_z -orbital axis are on the angles to x-ray irradiation direction and change their values in range $0^\circ \div 180^\circ$ by $\sim 30\%$ smaller than in the same fibres when p_z -orbitals are perpendicular to irradiation selection direction (fig.1).

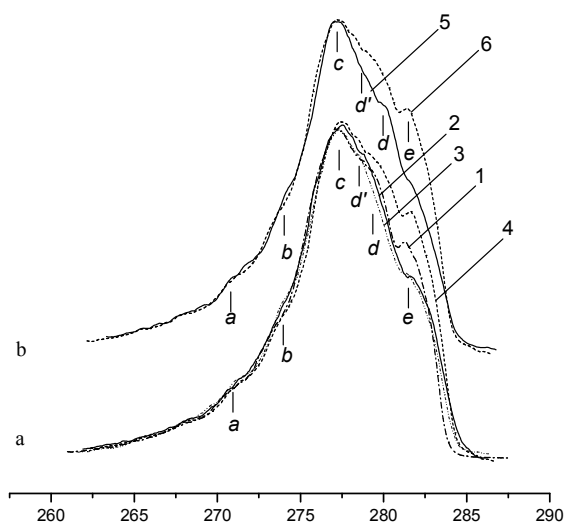


Fig 1. – The $CK\alpha$ -полос comparison: *a*) graphite (1), coarse carbon fiber oriented in three ways: I (2), II (3), III (4) and *b*) fine carbon fiber oriented in I (5), III (6).

The peculiarity in valence electrons energy distribution reflected the p_z -electrons additional interaction with electrons in mixed $\pi+\sigma$ -states that absent in graphite. It connected with angels between p_z -orbital axis as a result of graphene layers coaxial and spiral twist in carbon fiber.

The carbon fibers $CK\alpha$ -bands nanosize narrowing contour was revealed under the thinning owing to lowenergy displacement of short-wave (fig. 2). It points to π - and $\sigma+\pi$ -states energy decreasing as a result of their greater overlapping with considerable increase of more narrow graphene layers which number noticeably increased in nanofibres.

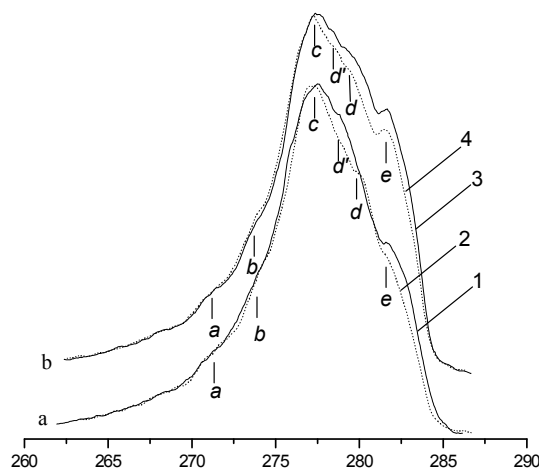


Fig. 2. – The X-ray emission bands comparison *a*) fibers oriented by method I – coarse (1) and thing (2), *b*) fibers oriented by method III – coarse (3) and thing (4).

Conclusions

The number of broken bands in graphen layers increasing leads to providing them $\sigma+\pi$ - and π -states degeneration. The consequence of it is valence electrons redistribution in nanofibers.

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