Doppler Broadening of Annihilation Line Study of Defect Structure in Advanced Optoelectronic Materials

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Doppler broadening of annihilation line (DBAL) method in positron annihilation spectroscopy is a powerful experimental tool for structural investigation of materials. The Doppler *S* and *W* lineshape parameters have characteristic values for each material, depending on the electron momentum distribution. Due to their low momentum, the annihilations with valence electrons fall predominantly in the region of the *S*-parameter (shape), while mainly core electrons have momentum values high enough to contribute to the *W*-parameter (wing); thus, *S* and *W* parameters are often called as valence and core annihilation parameter, respectively. When positrons are trapped, the lineshape is characteristic of the trapping defect. The larger concentration of vacancy-type defects, the lower the core annihilation parameter *W* and the higher the valence annihilation parameter *S*. At the same time, the dependence *S* vs. *W* is typically used to study a defect structure of materials. That is, when the samples exhibit the same slope of *S*-*W* plot (or dependence *S* vs. *W* is linear), one may suppose that their defect structure is similar. In the present work the recent results obtained on the DBAL study of defect structure in optoelectronic materials such as chalcogenide glasses [1,2], polymethylmethacrylate [3,4], and organic-inorganic ureasil-based composites [5] are reviewed. The deconvolution procedure with the Gold iterative algorithm used, permitting the measurement of small changes of the annihilation peak with high confidence, is approved.

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