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Two Key Challenges towards a More Sustainable World: Light-Weight, High Load Bearing Structural Materials and High-Efficiency, Functional Materials for Energy Storage

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Tailoring properties of structural and functional materials is strongly based on atomic defect analysis. Occurrence of these defects is in most cases associated with open volume for which positrons are an ideal and specific probe, e.g., by applying energy spectroscopy of the Doppler broadening of the two gamma photons of the positron-electron annihilation in general and in coincidence (CDB). It allows for specific analysis of defects and their kinetics in structural bulk materials as well as in functional thin films. In the ideal case, high spatial, surface and subsurface depth resolution in the micrometer range is achieved. Examples of own research will be given for *in-situ*, fast defect annealing in strongly deformed metals [1], precipitation hardening of light-weight aluminum alloys [2], and charging/discharging processes in thin film battery materials [3]. From the experience as long-term chairman of a review panel for this world-wide unique high-intensity positron beamline, future prospective applications with respect to the widening fields of light-weight structural materials as well as for materials for energy conversion and storage will be outlined. Demand for further improvements in resolution (time, lateral, and in-depth) of the beamline will be sketched. Also a sensitivity increase of the CDB method will be highly beneficial for the characterization of the chemical environment of atomic defects, i.e., vacancies.

References

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Author: SPRENGEL, Wolfgang (Graz University of Technology, Institute of Materials Physics)

Presenter: SPRENGEL, Wolfgang (Graz University of Technology, Institute of Materials Physics)

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