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Engineering: Neutrons, the perfect tool to study materials in engineering applications

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Due to the high penetration depth and large beam cross section of neutrons and the existence of advanced sample environments, neutron methods have received great attention as a suitable probe in the study of engineered materials, especially metals. This contribution focuses on examples of how neutrons have a great impact to solve open questions in industrial challenges. Examples as pipeline blockage, high-temperature alloy development, residual stresses in additive manufactured alloys and welded joints, needle clogging in medicine, irradiation of memory chips, electrolyte filling of batteries are presented using neutron diffraction, small-angle neutron scattering, neutron imaging, and prompt gamma activation analysis

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Dr Ralph Gilles is a physicist and heading the research group “Advanced Materials” with expertise in neutron scattering methods for studying energy materials as high-temperature alloys and batteries. At the FRM-II research reactor, he was working as an instrument scientist to design, built and brought into commission the structure powder diffractometer SPODI and the small-angle scattering instrument SANS -1 dedicated for materials science and magnetism at MLZ. In his group methods as diffraction, small-angle scattering, imaging, neutron depth profiling and neutron induced prompt gamma activation analysis are applied mainly for alloy and battery research. He has authored over 170 peer-reviewed articles (37 as first author) on topics ranging from instrumentation at large scale facilities, alloy development, thin films and ceramics over to in-situ and operando studies on batteries. Furthermore, he is the industrial coordinator for industrial use of scientific instruments at MLZ.

Primary author: Dr GILLES, Ralph (Head Advanced Materials, Heinz Maier-Leibnitz Zentrum (MLZ), TU München, Garching, Germany)

Presenter: Dr GILLES, Ralph (Head Advanced Materials, Heinz Maier-Leibnitz Zentrum (MLZ), TU München, Garching, Germany)

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