Quantitative Measurements of Residual Stress and Crystallographic Texture of Engineering Materials

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Because of its large spot size and high penetrability, neutron diffraction can provide the averaged crystal structure information of engineering materials and even monitor their microstructure and texture evolution in artificially simulated extreme environments. Although many novel engineering neutron diffractometers with either high or low thermal beam fluxes have been established for residual stress and texture measurements, there is still an expectation that the classical neutron diffractometers at nuclear research reactors, such as the Japan Research Reactor No. 3 (JRR-3), will be able to support broader neutron diffraction application studies [1-3] not limited to metals, alloys, ceramics, composites, and even geological materials.

In this presentation, we will briefly review the current status of the Neutron Diffractometer for Residual Stress Analysis (RESA), and then introduce the latest research highlights including the gradient residual stress distribution of induction hardened carbon steel S38C for high-speed train axles [4] and the cold rolling texture evolution of high entropy alloys as an advanced radiation-resistant structural material [5].

[1] P.G. Xu, K. Akita, H. Suzuki, N. Metoki, A. Moriai, *Mater. Trans.* 53, 1831 (2012).

[2] A. Yasue, M. Kawakami, K. Kobayashi, J. Kim, Y. Miyazu, Y. Nishio,T. Mukai, S. Morooka, M. Kanematsu, *Quantum Beam Sci.* 7, 15 (2023).

[3] Y. Miura, K. Suzuki, S. Morooka, T. Shobu, *Quantum Beam Sci.* 8, 1 (2024).

[4] T.Y. Qin, F.F. Hu, P.G. Xu, H. Zhang, L. Zhou, N. Ao, Y.H. Su, T. Shobu, S.C. Wu, *Int. J. Fatigue* 185, 108336 (2024).

[5] W. Fang, C. Liu, J.F. Zhang, P.G. Xu, T.X. Peng, B.X. Liu, S. Morooka, F.X. Yin, *Scripta Mater.* 249, 116046 (2024).