Potential of neutron transmission spectroscopy in magnetism and magnetics.

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Novel magnetic phenomena have been discovered in unprecedented environmental conditions or in newly found magnetic materials, where neutron diffractometry measuring neutrons scattered by the spins at various angles has been a unique tool for clarifying the spin arrangements directly. However, it is not easy to measure neutrons scattered at the sample under extreme environmental conditions such as ultra-high pressure, ultra-high magnetic field, and ultra-low temperatures, because the generations of such conditions are possible in smaller, narrower, or thinner sample space in the sample environment equipment; consequently, the equipment covers almost the whole aspects of the scattered neutrons. Also, it is difficult to promptly measure neutrons scattering of daily synthesized samples in magnetic material search, because large neutron facilities are unavailable without acceptance of experimental proposals and compact neutron sources available inside a laboratory are too weak to measure magnetic scatterings. To eliminate the bottleneck in magnetism, we note the plain fact that the neutrons transmitted through the material attenuate in proportion to the extent to which they are scattered. In this paper, we report the first observation of a magnetic Bragg dip and Bragg edge in the neutron transmission spectra of a typical spin order; clear antiferromagnetic Bragg dips and Bragg edges are found for a single crystal and powder of nickel oxide, respectively. The obtained results show that the neutron transmission spectroscopy is a promising tool both for advanced measurements under multi-extreme conditions and for daily analyses of spin structures using compact neutron sources [1].
In the presentation, I would like to also review current advances in neutron scattering instruments for materials science in japan

[1] H. Mamiya et al. Scientific Reports 7 (2017)15516.