Pulsed neutron imaging

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Neutron imaging using a pulsed neutron source is a very useful method since it has ability to give quantitative information on crystallography, element, temperature, and magnetic field as well as a traditional neutron transmission image. We are developing the pulsed neutron imaging method and expanding its application field[1]. Followings are examples of results obtained in the pulsed neutron imaging.

Martensite is little bit different characteristics compared with Ferrite phase. The lattice spacing, *d*, depends on carbon content and change depending on position. This gives gentle slope of the Bragg edge due to *d* distribution. Therefore, to analyze martensitic phase, we introduced a Gaussian distribution of the lattice spacing in the Bragg edge analysis code RITS to express realistic behavior in the martensite. From this analysis it is found that the width increased toward the periphery, which indicating increase of martensitic phase in this region. The trend was very similar to the distribution of Vickers hardness of the iron along radial direction.

As cultural heritage applications, Japanese swords were measured and in the transmission spectrum we found similar gentle gradient of Bragg edges to the martensite at edge area of the sword. We thought it was also martensitic phase. By analyzing this area by the RITS code, we succeeded in indicating the quenched region of the Japanese sword. Coins were measured and it was indicated that texture changed depending on its produced age.

With the use of resonance transmission we can obtain the elemental information. However, it is not easy to evaluate quantitatively. For this purpose we developed synthetic pulse function of the J-PARC neutron source and implanted it into the REFIT code. After then we succeeded in obtaining quantitative values.

To perform such measurement we are constructing a new imaging instrument, RADEN, at BL22, which will accept the first beam in November, 2014.

In the presentation we introduce principle and major activities in the pulsed neutron imaging.

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References

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