

18th International Conference and Exhibition on

MATERIALS SCIENCE AND ENGINEERING

May 28-30, 2018 Osaka, Japan



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New material by neutronic metamorphosis of fission product in nuclear fuel cycle

The spent nuclear fuel (SF) and high-level liquid waste (HLLW) must no longer be radioactive waste but a potential vein of rare metal. It is therefore quite natural that such none or less radioactive fission products (FPs) as Mo, Pd, In and REE (La, Nd, Dy, etc.) in SF or HLLW should be recovered and utilized as the secondary resource. Pd-Ru-Rh-TcO₂-based multi-element deposits from simulated HLLW by under-potential deposition (UPD) showed high catalytic reactivity for electrolytic H₂ production and thereby being the substitute material to Pt electrode. In Après Orient research initiated in 2011 at Tokyo Tech, the program relies on the extensive transmutation of FPs in the fast reactor by neutron capture reaction followed by β -decay like, ZFPA (n, γ) Z FPA+1 \rightarrow Z+1NRMA+1+ β^- , where reloaded highly radioactive ZFPA are expected to turn to be stable or very short-lived nuclear rare metals, Z+1NRMA+1. Among 40 elements, Ba/La, Pr/Nd, Gd/Tb/Dy, Tc/Ru, and Rh/Pd are the most promising as transmutation pair of ZFPA/ Z+1NRMA+1 under the various points of resourceability. Although non FPs pair, W/Re calls geopolitical and material attentions with creation of anti-high temperature super alloy. By applying a ZrD₂ moderator alternating to ZrH₂, an isotope fraction of radioactive Re187 can be decreased to the less level than that of natural Re.

Biography

Masaki Ozawa is a Professor Emeritus of Tokyo Institute of Technology (Tokyo Tech), started his career in 1975 as a Researcher at the Tokai-Reprocessing Plant of PNC, researched at IHCh/KfK in West Germany during 1981-1982 and has completed his PhD in 1993 from the University of Tokyo. He was a Professor (2011-2016) and the Chair (2014-2016) of the Department of Nuclear Engineering, Graduate School of Science and Engineering, Tokyo Tech. He has published more than 110 papers in reputed scientific journals and international conferences. He has also been serving as an Editorial Board Member of 5 journals including *Journal of Radioanalytical Nuclear Chemistry*.

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