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Inverse quenching effect of excited U(VI) ions by Eu(III) ions in aqueous solutions

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This talk will focus on energy transfer phenomena between hexavalent uranium (U) ions (U(VI)) and trivalent europium ions (Eu(III)). In the literature on this subject [1-3], the interaction between U(VI) and Eu(III) was explained as intramolecular energy transfer from excited U(VI) to Eu(III), and thus, the strong quenching of the luminescence of excited U(VI) by Eu(III) was observed. Because these earlier works were performed at relatively high U(VI) concentrations on the order of a few tens mM using conventional spectrofluorimetry, the precipitation of U(VI) at high pH values and the inner filter effect may interrupt the measurement of luminescence of U(VI).

In this work, the time-resolved laser luminescence spectroscopy was adopted to verify the quenching effect of excited U(VI) by Eu(III) at relatively low U concentrations on the order of a few microM. Two types of uranium materials, dissolved U species in aqueous solutions and adsorbed U species onto a silica surface, were prepared with a solution pH range of 4-7. For both U materials, it is apparent that energy transfer between U(VI) and Eu(III) involves the formation of a hetero-polynuclear complex between the hydrolytic U(VI) and Eu(III) species.

The new results observed in this work are as follows: (1) the $(\text{UO}_2)_3(\text{OH})_5^+$ hydrolytic compound is the major species taking part in the energy transfer process, (2) the first rising part appeared in the luminescence signal waveform of Eu(III) implies direct evidence of energy transfer process from U(VI) to Eu(III), and (3) the negative quenching effect of U(VI) by Eu(III) ions, which represents the enhancement of luminescence of U(VI) with increasing Eu(III) concentration, was observed in aqueous solutions and the reason can be understood in terms of enhanced absorbance of U(VI) for a hetero-polynuclear complex. A similar negative quenching effect of U(VI) by trivalent terbium ions was observed in acidic solutions [4]. Characteristic features on the luminescence and absorption spectra for this complex will be discussed.

[1] J.L. Kropp, J. Chem. Phys. 46 (1967) 843-847.

[2] B.D. Joshi, A.G.I. Dalvi, T.R. Bangia, J. Luminescen. 10 (1975) 261-266.

[3] S.P. Tanner, A.R. Vargenas, Inorg. Chem. 20 (1981) 4384-4386.

[4] T. Yamamura, Z. Fazekas, M. Harada, H. Tomiyasu, Phys. Chem. Chem. Phys. 1 (1999) 3491-3496.

Primary author: Dr JUNG, Euo Chang (Korea Atomic Energy Reserach Institute)

Co-authors: Dr CHO, Hye-Ryun (Korea Atomic Energy Reserach Institute); Dr PARK, Kyoung Kyun (Korea Atomic Energy Reserach Institute); Dr CHA, Wansik (Korea Atomic Energy Reserach Institute)

Presenter: Dr JUNG, Euo Chang (Korea Atomic Energy Reserach Institute)

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