

International Conference on

# Nuclear Chemistry

December 08-09, 2016 San Antonio, USA

## Ionic self-diffusion coefficients and structure of the trivalent lanthanide ion europium $^{152}\text{Eu}$ (III) in concentrated aqueous solutions and similarity with the transamericium ion $^{244}\text{Cm}$ (III)

N Ouerfelli<sup>1,2</sup>, R Besbes<sup>1</sup>, N Vrinceanu<sup>3</sup>, S Labidi<sup>1</sup>, E A El-Shazly<sup>4</sup>, H Latrous<sup>1</sup> and J Oliver<sup>5</sup><sup>1</sup>University of Tunis El Manar, Tunisia<sup>2</sup>University of Dammam, Saudi Arabia<sup>3</sup>L Blaga University of Sibiu, Romania<sup>4</sup>Atomic Energy Authority, Egypt<sup>5</sup>Oak-Ridge National Laboratory, USA

Ionic self-diffusion coefficients  $D$  of the lanthanide trivalent trace ion  $^{153}\text{Gd}$  (III) have been determined in supporting aqueous solutions of  $\text{Gd}(\text{NO}_3)_3 \cdot \text{HNO}_3$  over a large range of concentration in acidic medium ( $\text{pH}=2.50$ ) at  $25^\circ\text{C}$  by the open-end capillary method (O.E.C.M.). The method measures the transportation time of ion across a fixed distance. We optimized the pH in order to avoid the hydrolysis, pairing and complexing trivalent  $4f$  ions. The diffusion data obtained in large range of concentration as well as the physicochemical properties, allow to derive the following information: (i) the limiting value  $D^\circ$  at zero ionic strength, as  $5.985 \cdot 10^{-6} \text{ cm}^2\text{s}^{-1}$  for  $^{153}\text{Gd}$  (III), (ii) the validity of the Onsager limiting law, (iii) the ionic self-diffusion coefficient as a function of the ionic strength for asymmetrical 3:1 electrolytes in dilute solutions, (iv) a competition between ion-ion interaction and ion-solvent interaction and (v) a more extended law available for an intermediate range of concentration up to  $0.114 \text{ mol}\cdot\text{L}^{-1}$  and for a concentrated range up to  $1.5 \text{ mol}\cdot\text{L}^{-1}$ . This study contributes to demonstrate similarities transport and structure properties between  $^{153}\text{Gd}$  (III) and  $^{244}\text{Cm}$  (III) trivalent ions explained by a similar electronic configuration, ionic radius and same hydration number. These properties could also result from a long-range structuration of the concentrated ionic solution.

### Recent publications

1. D Humelnicu, N Vrinceanu, DD Dumitrascu, E Popovici, N Ouerfelli (2016) Photocatalytic properties of the systems based on uranyl-incorporated SBA-15 mesoporous silica. International Conference on Environmental Protection, Veszprém, Hungary, May 17-20.
2. DD Dumitrascu, E Popovici, N Vrinceanu, D Humelnicu, N Ouerfelli, RI Prepelita, I Gradinaru (2016) Photocatalytic performance of systems based on uranyl-incorporated SBA-15 mesoporous silica. Digest Journal of Nanomaterials and Biostructures 11: 381-392.
3. N Ouerfelli, D Das, H Latrous, M Ammar, J Oliver (2014) Transport behaviour of the lanthanide  $^{152}\text{Eu}$ (III),  $^{153}\text{Gd}$ (III) and  $^{170}\text{Tm}$ (III) and transplutonium element  $^{254}\text{Es}$ (III),  $^{244}\text{Cm}$ (III),  $^{241}\text{Am}$ (III),  $^{249}\text{Cf}$ (III) and  $^{249}\text{Bk}$ (III) ions in aqueous solutions at 298 K. Journal of Radioanalytical and Nuclear Chemistry. 300: 51-55.
4. R Besbes, N Ouerfelli, M Abderabba, P Lindqvist-Reis, H Latrous (2012) Investigation of the Self-Diffusion Coefficients of Trivalent  $\text{Gd}^{3+}$  in aqueous solutions: the Effect of Hydrolysis and nitrate ion association. Mediterranean J. Chemistry 1:334-346.
5. N Ouerfelli, D Das, H Latrous, M Ammar, J. Oliver (2013) Hydration of the lanthanide ions  $^{152}\text{Eu}$ (III),  $^{153}\text{Gd}$ (III) and  $^{170}\text{Tm}$ (III) in aqueous solutions at 298 K and similarity with the transplutonium element ions  $^{254}\text{Es}$ (III),  $^{244}\text{Cm}$ (III),  $^{241}\text{Am}$ (III),  $^{249}\text{Cf}$ (III) and  $^{249}\text{Bk}$ (III). Radiochemistry Symposium Feb. 19-23, India.

### Biography

N Ouerfelli has a PhD and Habilitation Diploma in Chemistry. He is the Head of Research Project in the Laboratory of Biophysics and Medical Technologies. He has published more than 45 papers in reputed journals on modeling of physicochemical properties in solution.

[nouerfelli@yahoo.fr](mailto:nouerfelli@yahoo.fr)

### Notes: