

**RERTR 2016 - 37<sup>th</sup> INTERNATIONAL MEETING ON  
REDUCED ENRICHMENT FOR RESEARCH AND TEST REACTORS**

**OCTOBER 23-27, 2016  
RADISSON BLU ASTRID HOTEL  
ANTWERP, BELGIUM**

**Characterization of ALD and PVD Coated U(Mo) Powders for  
EMPIRE Experiment**

F. Vanni<sup>1,2</sup>, X. Iltis<sup>1</sup>, H. Palancher<sup>1</sup>, J. Lamontagne<sup>1</sup>, B. Stepnik<sup>2</sup>, O. Tougait<sup>3</sup>, I. Glagolenko<sup>4</sup>,  
J.L. Schultness<sup>4</sup>, D.D. Keiser<sup>4</sup>, Y. Abdellatif<sup>5</sup>, S. Van den Berghe<sup>6</sup>, A. Leenaers<sup>6</sup>

<sup>1</sup>CEA Cadarache, DEN, DEC/SFER, Laboratoire des Combustibles Uranium  
F-13108 Saint-Paul-lez-Durance – France

<sup>2</sup>AREVA NP, CERCA, SPL, ZI Les Bérauds,  
54 avenue de la déportation, BP 114, F-26104 Romans-sur-Isère – France

<sup>3</sup>Université de Lille 1, Cité Scientifique, F-59650 Villeneuve d'Ascq – France

<sup>4</sup>Nuclear Fuels and Materials Division  
Idaho National Laboratory, P.O. Box 1625, Idaho Falls, ID 83415-6188 – USA

<sup>5</sup>Nuclear Engineering Division, Argonne National Laboratory,  
9700 S. Cass Ave., Argonne, IL 60439 – USA

<sup>6</sup>Nuclear Material Science Institute, SCK-CEN, Boeretang 200, 2400 Mol – Belgium

**ABSTRACT**

To reduce nuclear proliferation risks, substantial efforts are conducted to develop low <sup>235</sup>U enriched fuels (LEU) to convert research reactors cores. HERACLES is the European consortium that supports U(Mo) LEU conversion fuel for Europe. HERACLES and US-DOE are working jointly to produce U(Mo) LEU dispersed mini-plates to be irradiated in the EMPIRE experiment. The irradiation is scheduled in ATR reactor (US) in 2017.

Within EMPIRE, the influence of (i) U(Mo) homogenization by heat treatment, (ii) ZrN coating by different processes on the behavior under irradiation of dispersed fuel, will be tested. The chosen coating processes are physical vapor deposition process (PVD), developed by SCK-CEN (Belgium), and atomic layer deposition process (ALD), developed by ANL (US).

Different batches of LEU U(Mo) particles, which will be used for EMPIRE irradiation, have been analyzed using XRD, SEM, EBSD, EDX and EPMA technics. This work is aimed to characterize the U(Mo) powder “bulk” properties (grain size, Mo distribution...) and coating features (thickness...), before irradiation, to provide reference state data for studying the U(Mo) particles behavior under irradiation.