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**Microstructural characterization of SEMPER FIDELIS  
fresh fuel plates**

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**ABSTRACT**

The HERACLES group works to develop dispersed U(Mo)/Al as LEU fuel for conversion of high performance nuclear research reactors. Within this frame, the SEMPER FIDELIS irradiation program is conducted in BR2 on U(Mo)/Al full-size plates, with optimized microstructure. U(Mo) powder treatment was performed at SCK-CEN and full size plates were manufactured by CERCA.

This paper is focused on Microstructural examinations performed at CEA Cadarache on three fresh fuel plates (named SF2, SF4 and SF5).

The SF2 plate was made with U(Mo) particles homogenized at 1000 °C – 1 h and the two others (SF4 and SF5) were made with as-atomized particles. SF2 and SF4 U(Mo) particles are ZrN-coated, whereas SF5 ones are Si-coated. The comparison between these three plates thus covers both the metallurgical state of U(Mo) (homogenized or not) and the coatings features.

The effect of the heat treatment at 1000 °C on grain size,  $\gamma$ -U(Mo) and  $\alpha$ -U mass ratios, and Mo micro-segregations within the particles are studied. The ZrN coating thickness and integrity as well as the characteristics of the interdiffusion layer formed on the Si-coated particles are also assessed.