

# Full Field Approach for Modelling of Microstructural Evolutions during Forming Processes

P.O. De Micheli<sup>1,a</sup>, S. Andrietti<sup>1,b</sup>, N. Poulain<sup>2</sup>, M. Bernacki<sup>3</sup>

<sup>1</sup>TRANSVALOR S.A. 950 avenue Roumanille, CS 40237 Biot, 06904 Sophia Antipolis, France

<sup>2</sup>TRANSVALOR AMERICAS 17 North State Street, Suite 1700, Chicago IL 60602 USA

<sup>3</sup>MINES ParisTech, PSL-Research University, CEMEF-Centre for Material Forming, CNRS UMR 7635, CS 10207rue Claude Daunesse, 06904 Sophia-Antipolis CEDEX, France

<sup>1,a</sup> Corresponding author: pascal.demicheli@transvalor.com – phone : +33 492 92 38 60

<sup>1,b</sup> stephane.andrietti@transvalor.com - phone : +33 492 92 42 11

<sup>2</sup> nicolas.poulain@transvaloramericas.com - phone : +1 312 348 7615

<sup>3</sup> marc.bernacki@mines-paristech.fr - phone : +33 493 67 89 23

## **ABSTRACT**

A major trend in the manufacturing industry comes with the concept of 'Material Design' to predict microstructure evolutions of metallic alloys occurring during forming processes. Regarding FEM simulations, most of the existing models are based on classical phenomenological Mean Field approaches which obviously are somehow limited. This is the reason why innovative Full Field approaches have been recently developed in order to enable the direct modelling of a polycrystal on a Representative Element Volume. Therefore, various phenomena such as boundary migration, hardening, recovery, nucleation, grain growth driven by capillarity are observed and understood at the grain scale.

This paper aims at demonstrating the benefits of Full Field finite element microstructural simulations applied to forming processes used in the field of open-die forging. Results obtained with the so-called commercial software DIGIMU® on 304L monophasic stainless steel will be discussed.

TRANSVALOR S.A.  
950 avenue Roumanille  
CS 40237 Biot  
06904 Sophia Antipolis cedex – France  
+33 (0)4 9292 3865  
[marketing@transvalor.com](mailto:marketing@transvalor.com)