

# Author's Accepted Manuscript

Paint-bake Effect on the Plasticity and Fracture of  
Pre-strained Aluminum 6451 Sheets

Rami Abi Akl, Dirk Mohr



PII: S0020-7403(17)30021-8

DOI: <http://dx.doi.org/10.1016/j.ijmecsci.2017.01.002>

Reference: MS3540

To appear in: *International Journal of Mechanical Sciences*

Received date: 5 August 2016

Revised date: 18 December 2016

Accepted date: 4 January 2017

Cite this article as: Rami Abi Akl and Dirk Mohr, Paint-bake Effect on the Plasticity and Fracture of Pre-strained Aluminum 6451 Sheets, *International Journal of Mechanical Sciences*, <http://dx.doi.org/10.1016/j.ijmecsci.2017.01.002>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# Paint-bake Effect on the Plasticity and Fracture of Pre-strained Aluminum 6451 Sheets

Rami Abi Akl<sup>1</sup>, Dirk Mohr<sup>2</sup>

<sup>1</sup>Impact and Crashworthiness Laboratory, Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge MA, USA

<sup>2</sup>Department of Mechanical and Process Engineering, Swiss Federal Institute of Technology (ETH), Zurich, Switzerland

## Abstract

In automotive engineering, sheet metal components are subject to a 20-30min heat treatment at 180C during paint baking. This process may significantly alter the mechanical properties of 6000-series aluminum alloys through artificial ageing. Here, a comprehensive experimental program is carried out to characterize the anisotropic plasticity and the fracture initiation in pre-strained artificially-aged aluminum 6451 sheets. It is found that the combination of pre-straining up to 5% strain and heat treatment mainly changes the material's strain hardening behavior and the stress-state sensitivity of its fracture response. The material parameters of the Yld2000-2d plasticity model with combined Swift-Voce hardening are identified for four distinct materials from uniaxial tension and shear experiments. The corresponding Hosford-Coulomb fracture model parameters are determined from smiley shear, V-bending and punch experiments. As an important byproduct of the research, the Yld2000-2d and Hosford-Coulomb models are successfully validated for all four materials through notched and central hole tension experiments. Simple empirical expressions are also provided to estimate the material properties as a function of the pre-strain in engineering practice.

*Keywords:* Artificial ageing, paint-bake, Yld-2000, stress triaxiality, Lode angle, ductile fracture

## 1. Introduction

Download English Version:

<https://daneshyari.com/en/article/5016238>

Download Persian Version:

<https://daneshyari.com/article/5016238>

[Daneshyari.com](https://daneshyari.com)