

# #474 Additively manufactured tensile ring-shaped specimens for pipeline material fracture examination - influence of geometry

Isaak Trajković<sup>1</sup>, Miloš Milošević<sup>1</sup>, Marko Rakin<sup>2</sup>, Nebojsa Bogojevic<sup>3</sup>, Snezana Ciric-Kostic<sup>3</sup>, Filippo Berto<sup>4</sup>, Bojan Medjo<sup>2</sup>

*1Innovation Center of the Faculty of Mechanical Engineering, Kraljice Marije 16, 11100, Beograd, Serbia.*

*2University of Belgrade, Faculty of Technology and Metallurgy, Karnegijeva 4, 11120, Belgrade, Serbia.*

*3University of Kragujevac, Faculty of Mechanical and Civil Engineering in Kraljevo, Dositejeva 19, 36000, Kraljevo, Serbia.*

*4Department of Mechanical and Industrial Engineering, NTNU – Norwegian University of Science and Technology, Trondheim, Norway.*

*PRNT*

*Additive manufacturing*

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**Abstract** In order to define a procedure for integrity assessment of pipelines and determining the fracture mechanics parameters, a new type of specimen with a sharp notch, Pipe Ring Notched Tension (PRNT) specimen, is tested. The aim of the study is to determine the influence of the specimen geometry (cylindrical shape, as well as number and length of stress concentrators) on parameters such as force, Crack Mouth Opening Displacement CMOD, Crack Tip Opening Displacement CTOD and J integral. The specimens were fabricated by an additive production method - selective laser sintering (SLS). EOS Formiga P100 machine is used, and the material is polyamide PA12. In addition to Pipe Ring Notched Tension specimens, Single Edge Notched Tension (SENT) specimens with identical cross section were also made by the same technique. All specimens were tested on a universal tensile testing machine. A tool specially designed to apply contact pressure to the inner walls in the tension direction was used, simulating the internal pressure. SENT specimens were tested with a standard tensile plate test tool. For determining the field of displacement and strain on the surface of the tested samples that occur during the loading, Aramis GOM 2M optical measurement system was used. Aramis is applied for determination of geometry fracture mechanics parameters: CMOD and CTOD (based on  $\delta 5$  concept). In addition to the examination of fracture properties of additively manufactured PA12, the main topic of this work is the development of the non-standard testing procedure, which will be subsequently applied to the specimens cut from metallic or non-metallic pipes. As an important part of this procedure, the calculation of fracture parameters is also considered.

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