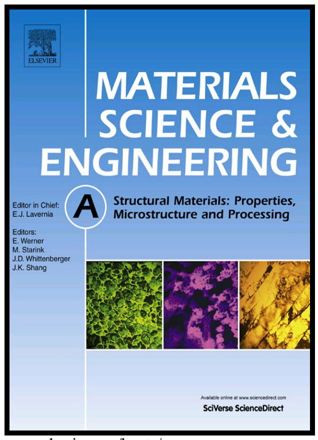

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Determination of the Young's modulus in CuAlBe shape memory alloys with different microstructures by impulse excitation technique

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Abstract
The Young's modulus (*E*) was determined in samples of CuAlBe shape memory alloys with selected grain sizes using the non-destructive technique of impulse excitation. The variation of *E* with the quenching temperature reached after a slow cooling from 1073 K was also studied and the microstructure of quenched samples was characterized by optical microscopy. A strong dependence of *E* with the grain size was found and a comparison of the obtained results with values reported in the literature was done. The behavior of *E* with the quenching temperature was analyzed considering the formation of γ_2 and α' precipitates, the presence of martensite in the β matrix, the reordering process and the vacancy concentration. The impulse excitation experimental device was specifically developed and mounted. An evaluation of its performance was made by means of measurements of the modulus *E* in samples of materials commonly used (commercial aluminum and copper) and using different vibration modes. The obtained results evidence the potentialities of the impulse excitation technique for the determination of the modulus *E* in alloys with a complex microstructure, which allows to characterize the behavior of *E* with the quenching temperature in the alloy studied.

Keywords:
Light microscopy; mechanical characterization; non-ferrous alloys; shape memory alloys; thermomechanical processing; grain growth.

1.- Introduction

The proper determination of the elastic constants of a material is of great significance from a scientific point of view because it allows to analyze microstructural parameters of a solid. In technological applications this is of paramount importance because it establishes the input for structural calculus in engineering design. The measurement of the elastic constants can be done by different experimental methods, and the most commonly applied are classified as static or dynamic. The static techniques, in their different forms (e.g. tensile, compressive, and flexural), are probably the most frequently used in the academic and technological field, and their use has been documented since decades ago. An advantage of the static techniques is that they usually allow to obtain a complete characterization of the mechanical behavior of the samples. However, it is required specific equipment and the use of extensometers is necessary for the correct determination of the strain. The instrumented indentation can