

# Study of dislocation-mediated internal friction in solid solution strengthened alloys

Abhijith Brijesh Mohan<sup>1,2\*</sup>, Pierre-Antoine Geslin<sup>1,2</sup>, Véronique Massardier-Jourdan<sup>1</sup>

<sup>1</sup> Univ. Lyon, CNRS, INSA Lyon, Université Claude Bernard Lyon 1, MATEIS, UMR5510, 69100 Villeurbanne, France

<sup>2</sup> ELyTMaX IRL3757, CNRS, Univ. Lyon, INSA Lyon, Centrale Lyon, Université Claude Bernard Lyon 1, Tohoku University, Sendai, Japan

\*[abhijith.brijesh-mohan@insa-lyon.fr](mailto:abhijith.brijesh-mohan@insa-lyon.fr)

## Résumé pour poster

Solid solution strengthening, a means of strengthening alloys by the presence of solute atoms in a matrix, is typically combined with other strengthening mechanisms (Hall-Petch, strain-hardening) to obtain technologically relevant alloys such as Al 1xxx and 5xxx alloys, and austenitic steels. Therefore, isolation of the solid solution contribution is often difficult and time consuming by conventional methods such as tensile tests. This work aims to quantify the solid solution strengthening in solid solution FCC alloys by using internal friction measurements, which measures the energy dissipation/damping of a material subject to an elastic, oscillating stress. At temperatures low enough to suppress diffusion mechanisms for a particular alloy system, the main factor for internal friction (IF) are the dislocation-solute interactions. Based on the amplitude of the applied stress, the dislocation behaviour will differ. At low amplitudes (which is system dependent), the dislocation remains pinned by the solutes and simply oscillate between different energy levels, which makes the IF amplitude-independent. Above a certain amplitude, the dislocation is subject to break-away from the pinning points due to microplastic yielding, and IF is therefore amplitude-dependent [1]. These two regimes can be modelled using a two-level system approach [2] and the Varvenne-Curtin model [3], respectively. By studying the internal friction experimentally and with the modelling approach, the goal is set to isolate and quantify the solid solution strengthening component. In addition to this, this work aims to also indirectly measure dislocation density in alloys using IF measurements. The experiments will be carried out on model binary and ternary alloys – the Al-Mg system and the Fe-Cr-Ni system, which are representative of real-world solid solution FCC alloys.

## References

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