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Coupled corrosion-resonant frequency evolution monitoring

Introduction

The Impulse Excitation Technique (IET) measures the resonant frequency and the internal friction of a sample. Using a dedicated Resonant Frequency and Damping Analyser (RFDA) software (IMCE, Belgium), is possible to calculate the elastic property changes. IET can be combined with crucible (static) corrosion tests. Static tests can provide data regarding formation of new phases and infiltration depth.

Sample Preparation

In order to combine static corrosion with monitoring of in situ resonant frequency up to 1500°C, special moulds were designed to create the necessary hollow space (136.5 mm x 11.5 mm x 6.6 mm, Fig. 1) [1]. The hollow space idea [2] was modified, so instead of a depression on sample's (150 mm X 25 mm X 32 mm), top surface, the hollow space (to accommodate the corrosive medium) was created while slurry was casted on the moulds.

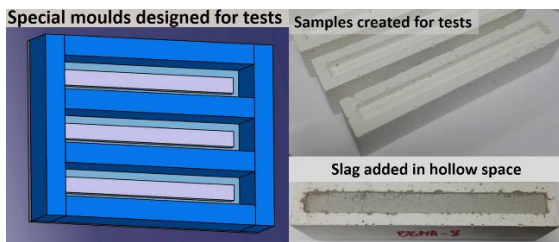


Figure 1 – Sample preparation.

Test Procedure

To perform a measurement, a sample filled with 8 g of corrosive medium (Fig. 1) is supported in two points and tapped with an automatic excitation unit (Fig. 2). A microphone captures the vibration signal emitted by the sample, which is then sent to the RFDA software. The vibration signals acquired from flexural vibrations are converted to the frequency domain by FFT using RFDA software. Then, the flexural frequencies are used to calculate dynamic Young's modulus.

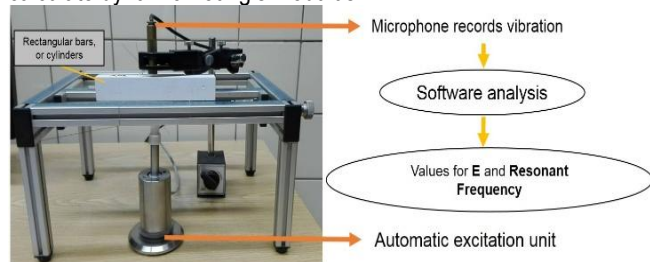


Figure 2 – Experimental setup.

Resonant frequencies of flexural vibrations are measured every 30 sec from ambient T to 1500°C (dwell time 1 h) and back to ambient T. Finally, in order to evaluate the effect of corrosive media, samples filled with corrosive inside the hollow space and without (blank) are tested simultaneously.

Expected Result

By adapting the crucible test into IET, we can correlate elastic property evolution and microstructural changes.

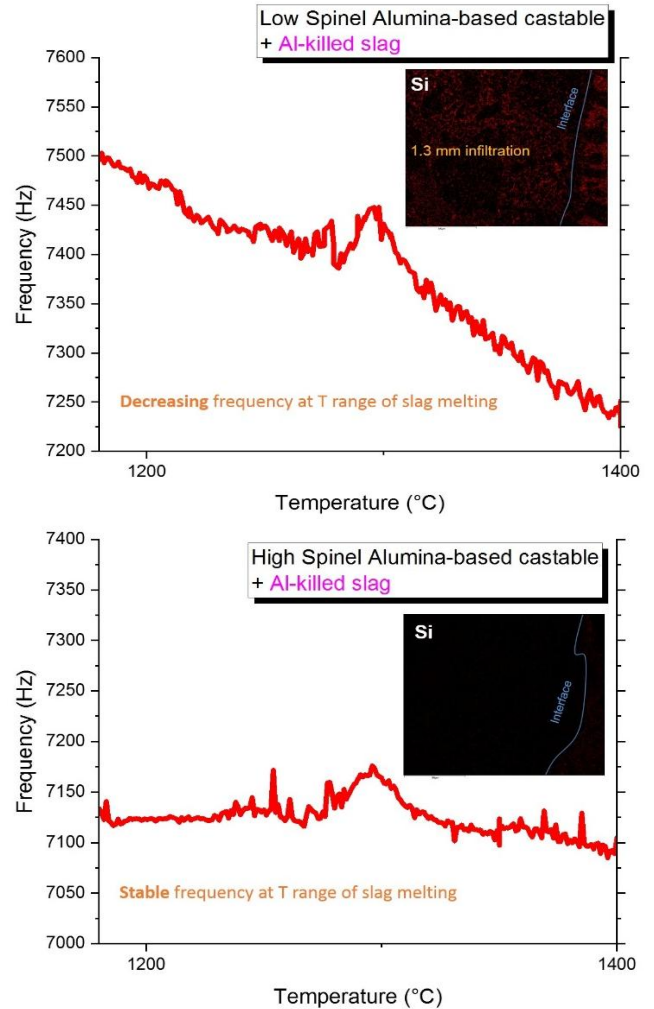


Figure 3 – Microstructural changes (SEM/EDS) and resonant frequency evolution in heating, measured by High Temperature RFDA device (adapted from [1]).

Acknowledgments

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References

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