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Hot disk method

Introduction

The transient plane source (TPS) technique is well known with the name of hot disk method. This technique allows thermal conductivity measurements of a wide range of material types (liquids, solids, powders). The advantages are many, but in particular the ability to simultaneously measure the thermal conductivity, thermal diffusivity and specific heat capacity of complex materials [1][2].

Sample Preparation

Square samples with a surface area of 70x70 mm^2 and 25-32 mm in thickness (depending on the availability) are prepared. The only important characteristic is to have two flat surfaces in contact with the probe. For each measurement, two samples are necessary.

Test Procedure

The TPS sensor is a double nickel spiral supported by two thin sheets of an insulating material (kapton, mica or teflon), placed between two halves of the same material (Figure 1). This sensor has a double function: as a heat source for increasing the temperature of the materials and as a "resistance thermometer" for recording the resistance (temperature) increase as a function of time.

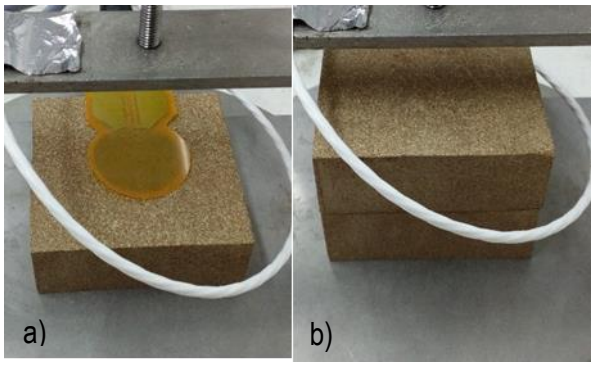

Figure 1: Experimental setup. a) TPS sensor is placed on one sample; b) TPS sensor is covered by the second sample.

Certain parameters need to be chosen: the radius of the probe (depending on the dimensions of the samples); the kind of sensor (depending on the temperature range to measure); the heating power (to have a temperature increment of 2-5 K); the measurement time (for recording n-points and having a total characteristic time of at least 0.4). All these parameters are chosen to guarantee a maximum probing depth, which is less than the minimum distance between the sensor and the borders of the sample, in radial and axial directions. This is important because the theory considers the sample as an infinite medium.

Expected Result

Figure 2 shows a classical transient curve. From this curve an amount of initial points (10-20) are excluded from the analysis because the theory assumes a perfect contact between the probe and the two surfaces in contact with it.

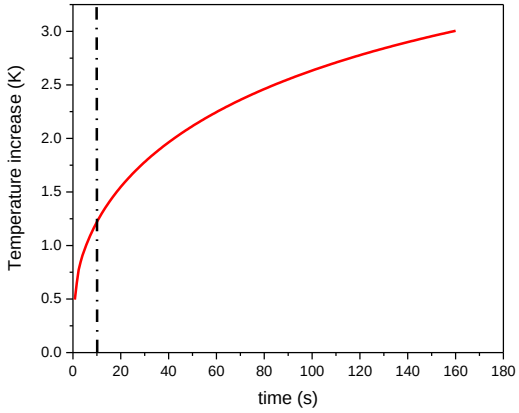

Figure 2 – Expected results.

Acknowledgments

This work was supported by the funding scheme of the European Commission, Marie Skłodowska-Curie Actions Innovative Training Networks in the frame of the project ATHOR - Advanced THermomechanical multiscale mOdelling of Refractory linings 764987 Grant.

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European Commission | Horizon 2020 European Union funding for Research & Innovation

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