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NOTE

A Novel Device for the Dilatometric Study

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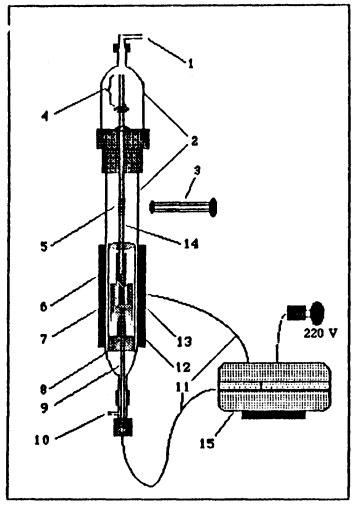
In this work we are interested to develop an adequate dilatometric method which allows to measure quantitatively the dimensional changes occurring during thermal treatment of solids and most precisely to determine their specific characteristics. The research allowed us to realize an experimental dilatometer able to follow the evolution of dimensional changes of solids whatever their physical and chemical nature is. With the help of this new device, the experimental results show that the temperature phase transformations and the thermal stability of the studied samples become easily accessible to the operator of these materials.

Dilatometry yields information on dimensional changes of solids by thermal treatment. This information contributes to the development of science of materials. In fact, elevated temperature introduces in the solid volume variation or chemical transformations, mechanical strength reduction and causing various cracks which act as passages for diffusion of gas from the inside, etc.

In dilatometry analysis we usually confront a problem of mechanical compulsion at the level of the sample according to the working principle of the employed analysis system. The present dilatometer is based on the detection free extremity of detector with ambient temperature and controlled gas atmosphere. The mechanical constraint trained by weight of detector placed on the sample could introduce some errors on the real dimensional variations. This problem has been observed in previous works on pyrolysis of oil shale[1] and on thermal treatment of wood[2]. To solve this, we have realized to develop a new dilatometer (Fig. 1). This system allows the control and variation of external mechanical constraints introduced by marked mass placed on the top of the detector. Consequently, we can plot changes per unit length caused only by thermal compulsion.

As an example of the application of this apparatus, we present in Fig. 2 dimensional variation of xylan under an inert atmosphere from the ambient temperature to 560°C. Pastille shaped specimen was used to carry out this dilatometric experiment under a nitrogen flow rate of 15 cm^3 min^{-1} and a heating rate of 15°C min^{-1}.

Using this new system, attractive results were obtained in the context of thermal analysis for synthetic polymers (PEEK, PEKK) used in a high performance composite materials[3–5]. These would be published soon together with natural polymers (xylan, cellulose, lignin) and Moroccan wood species.



1 Gas inlet
2 Silica tube
3 Field glass
4 Support of marked mass
5 Stenciller
6 Oven
7 Sample
8 Sample holder
9 Thermocouple
10 Gas outlet
11 Electrical linen
12 Fixed cylinder
13 Movable cylinder
14 Silica stem
15 Temperature system control

Fig. 1. Dilatometric apparatus

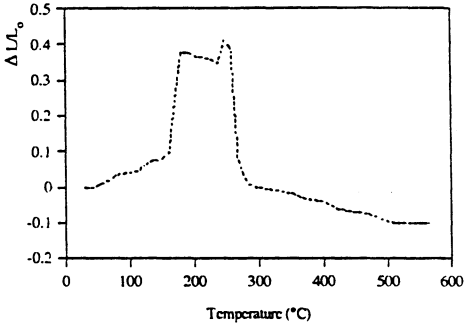


Fig. 2. Déformation of xylan pastille with temperature

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