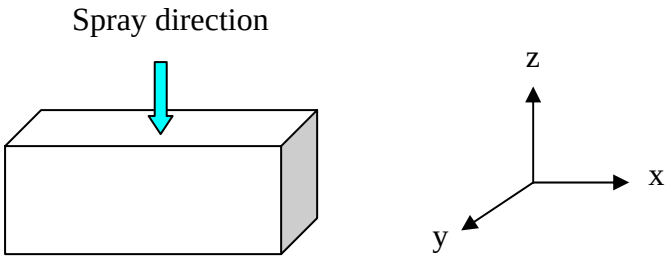
UNIVERSITY OF CAMBRIDGE

Determination of Porosity from Dilatometric Experiments for Transversely Isotropic Materials



The initial volume of the specimen is given by (V_i) = xyz
The final volume (V_f) of the specimen after heat treatment is given by –

$$V_f = (x+\Delta x)(y+\Delta y)(z+\Delta z)$$
$$= xyz + xy\Delta z + x\Delta yz + \Delta xyz + x\Delta y\Delta z + \Delta x\Delta yz + \Delta xy\Delta z + \Delta x\Delta y\Delta z$$
$$\sim xyz + xy\Delta z + x\Delta yz + \Delta xyz$$

So the change in volume is given by –

$$V_f - V_i = xy\Delta z + x\Delta yz + \Delta xyz$$

Fractional change in volume is given by –

$$\frac{V_f - V_i}{V_i} = \frac{xy\Delta z + x\Delta yz + \Delta xyz}{xyz}$$

This gives the fractional change in volume as-

$$\frac{V_f - V_i}{V_i} = \frac{\Delta x}{x} + \frac{\Delta y}{y} + \frac{\Delta z}{z}$$

For Plasma sprayed materials, the change in x and y direction are the same and that in z direction is different. Thus we can write the above equation as –

$$\frac{V_f - V_i}{V_i} = \frac{2\Delta x}{x} + \frac{\Delta z}{z}$$

If there is no weight loss with heat treatment, the fractional change in volume will give the change in porosity.

Thus, dilatometric experiments accompanied by DTGA will give the variation of porosity of such materials.

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