METHOD OF PREPARING AND CHARACTERISING MULTILAYER CERAMIC STRUCTURES BASED ON PORCELAIN TILE AND A MONOPOROSA STRUCTURE

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1. INTRODUCTION

Ceramic materials display many attractive features which afford them superior characteristics in comparison to other materials; examples include low density, hardness, good refractory characteristics, chemical and corrosion resistance, apart from specific electrical, optical and magnetic properties. However, their inherent brittleness restricts their use in certain structural applications. Increasing fracture toughness is a significant factor in the development of more reliable ceramic materials. Specifically, the production of multilayer ceramics is a projected way of increasing their resistance to toughness. The literature contains many methods of manufacturing multilayer ceramics but some of these are highly complex and difficult to reproduce in the fast-firing cycles used by today's ceramic industry. This paper describes the development of a device that enables multilayer ceramics to be produced by using powders with less than 10% moisture content taken from industrial manufacturing formulations of porcelain tiles and monoporosa.

2. MATERIALS AND METHODS

Figure 1 illustrates the method to prepare multilayer ceramics. Once the first layer has been formed, a second substrate is laid on top in the same way until the required thickness is achieved.

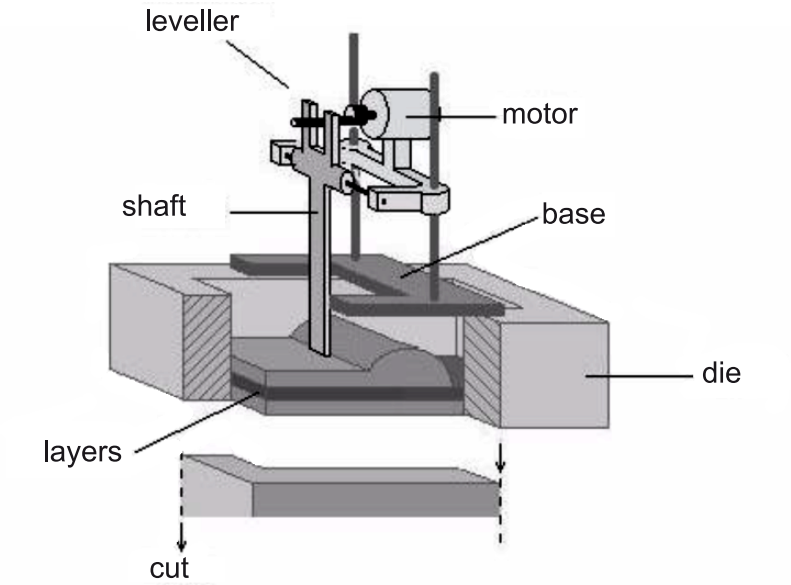

Figure 1. Device for making multilayer ceramics using powders with low moisture content.

3. RESULTS

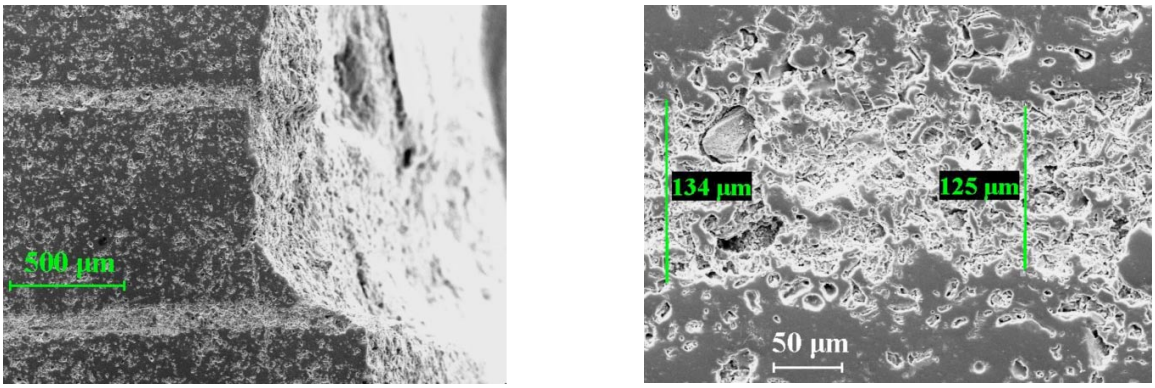

Figure 2. SEM of multilayer systems: (a) Overall (b) Magnified region of the porous layer.

Samples	Deform. (mm)	RF (MPa)	E fract. (J/m³)
Porcelain tile	0.10	44.11	2035
Monoporosa	0.10	12.82	492
multilayer	0.25	32.29	7756

Table 1. Mechanical properties of fired ceramic test pieces.

Samples	RS(%)	RQ(%)	WA(%)	PA(%)	Pdry(%)	LOI(%)	Dap (g/m³)	Dapt (g/m³)
Porcelain tile	0.10	7.25	1,70	3.94	2.14	3.99	2.32	2.25
Monoporosa	0.00	-0.19	20.88	34.79	1.60	12.62	1.67	1.64
multilayer	0.10	2.88	4.37	9.47	1.94	4.71	2.17	2.11

Table 2. Physical characterization of monolithic and multilayer system test pieces.

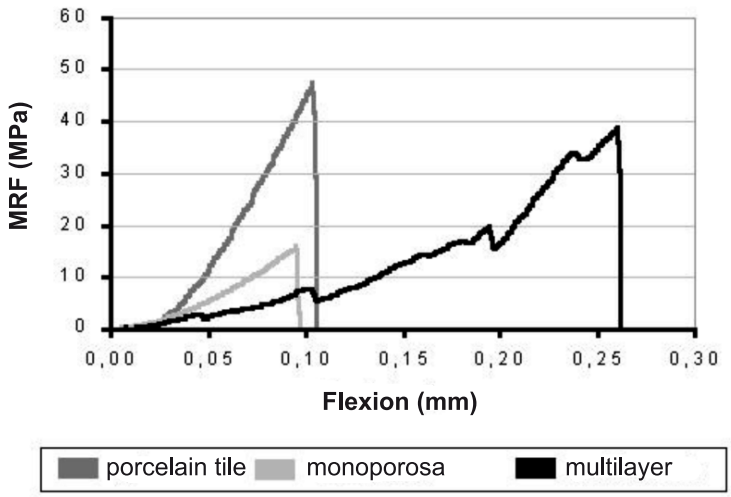

Figure 3. Bending strength curves of monolithic and multilayer system test pieces.

4. CONCLUSIONS

The fracture energy (E fract.) obtained for the multilayer ceramic test pieces was approximately four times higher than the monolithic sample made of porcelain stoneware, and almost sixteen times greater than that of the monoporosa layer, which illustrates the significant increase in toughness obtained with multilayer systems in this study.