SHEAR STRENGTH OF ADHESIVES FOR CERAMIC MATERIALS

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1. ABSTRACT

The mechanical performance of six commercial adhesives of different chemical nature was studied. To do so, a method was fine-tuned and shear strength was determined by means of compression tests. Shear strength is the most representative property of the bond and cohesive strength of adhesives. The study of the load–strain curve of the different adhesives showed that, in general, the failure pattern was plastic and cohesive and shear strength increased with maturing time. However, the values of these properties clearly depended to a large extent on the nature of the adhesive used.

2. EXPERIMENTAL PROCEDURE

2.1. TEST SPECIMEN PREPARATION

Each test specimen was made up of two tiles measuring 11x11cm, 2cm thick, cut from industrial porcelain tiles. The adhesive was applied onto the glazed surface of one tile of each two-tile test specimen, using a template that contained five openings, 15mm in diameter. Spacer rods were set on the adhesive and the other test tile of the same size was then placed on top of the spacer rods, with a 6mm displacement. The assembled test specimen was set on a flat surface and a 70N load was applied for 3min. The spacer rods were then removed.

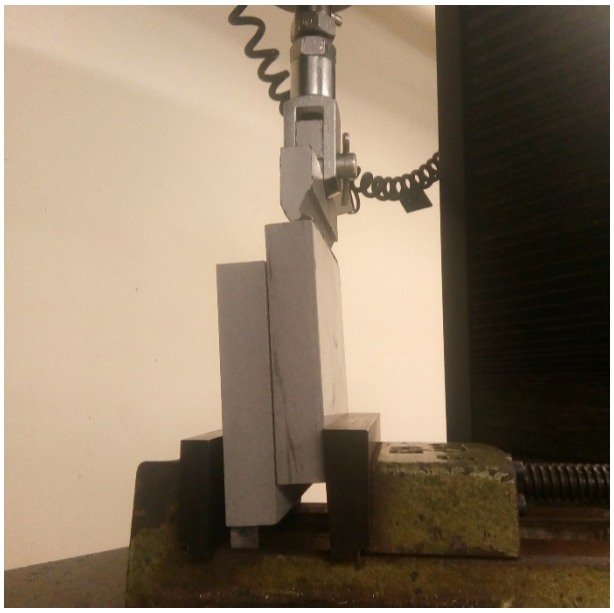

Figure 1. *Assembled two-tile test specimen in the shear test stand of the universal testing machine.*

2.2. COMPRESSIVE SHEAR STRENGTH TEST

After 15 days, each assembled test specimen was placed in a shear test stand to convert the compressive load into shear force. The assembled test specimen was set in a universal testing machine in which a compression force was applied at a rate of 5mm/min. Load and strain were simultaneously recorded until failure occurred (Figure 1).

In the experiments aimed at determining the effect of maturing time on shear strength, maturing time was modified from 7 to 30 days.

3. RESULTS AND DISCUSSION

Six commercial adhesives of different chemical nature were selected. Four samples were tested for each adhesive and maturing time. By way of example, the breaking strength of each sample after 15 days maturing and the average and standard deviation of the measurements are detailed in Table 1. Analogously, Figure 2 shows three load–strain curves of the polyurethane adhesive after 7 days maturing. The fracture pattern was observed to be plastic and cohesive in every case.

Adhesive	736	Sikaflex 265	AS 1805	DP 805	Olibond	AV 138
Breaking strength (N)	1661	3231	974	42498	1758	20926
	1254	4285	930		1765	
	926	4443	898		784	
	1584	3551	1191		877	
Average (N)	1356±337	3878±581	998±132	>40000	1296±539	>20,000

Table 1. *Breaking strength obtained in compressive shear strength tests after 15 days maturing.*

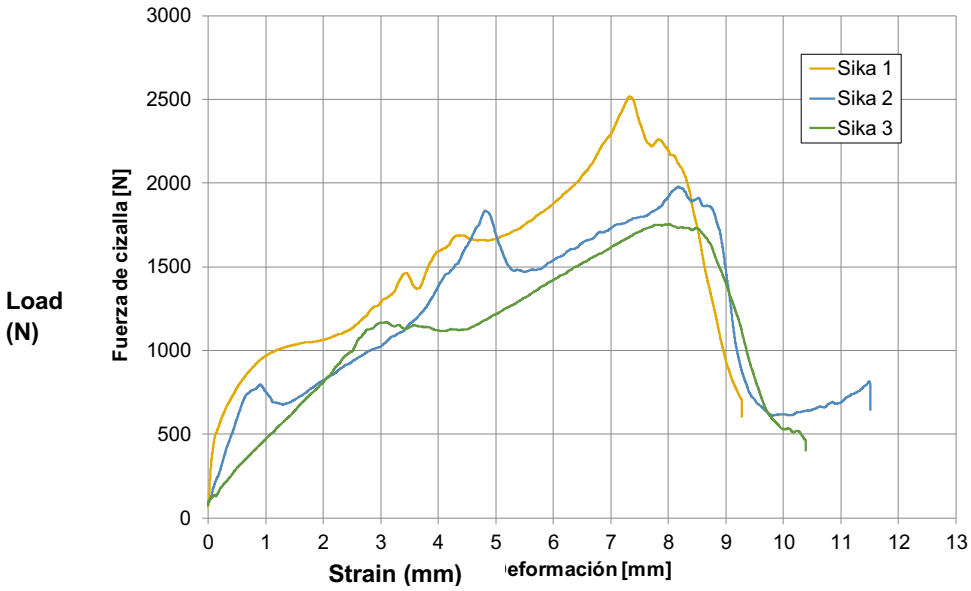

Figure 2. *Load–strain curves of the Sikaflex 265 adhesive after 7 days maturing.*

Increased roughness of the surface onto which the adhesive was applied was observed to reduce bond strength. An increase in maturing time was, in general, found to lead to higher compressive shear strength, strain at the fracture point, and cohesiveness of the bond.