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Squeeze flow coupled with dynamic pressure mapping for the rheological evaluation of cement-based mortars

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1 Squeeze flow coupled with dynamic pressure mapping for the rheological 2 evaluation of cement-based mortars

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9 ABSTRACT

10 The squeeze flow test provides relevant information about the macroscopic
11 rheological behavior of mortars. Nevertheless, the identification and
12 characterization of micro and meso physical phenomena is necessary for a
13 more thorough analysis. This work presents an experimental methodology that
14 combines the squeeze flow test with a pressure mapping system for the
15 rheological evaluation of cement-based mortars. Two compositions were
16 analyzed, with and without viscosity modifying cellulose ether based admixture,
17 and the liquid phase migration was quantified to support the interpretation of the
18 results. The developed pressure mapped squeeze flow (PMSF) method allowed
19 for reliable measurement of the evolution of the pressure distribution on the
20 whole area of the squeezed sample, and the results were compared with
21 theoretical models for different flow types of Newtonian fluids. The presence of
22 the cellulose ether admixture resulted in more homogeneous flows, which
23 enabled bigger displacements and generated less fluctuations in the pressure
24 distributions.

25 *Key words: mortar; squeeze-flow; pressure mapping; pressure distribution;*
26 *phase separation.*

27

28 1 INTRODUCTION

29 The squeeze flow test is based on the compression of a sample between two
30 parallel plates subjecting the material to shear and/or elongational radial flows.
31 and has been widely employed for the rheological evaluation of foods, biofluids,
32 cosmetics, polymers, ceramics, composites and several other classes of
33 materials [1]. It is an useful technique that does not display some issues that
34 may take place in rotational rheometry such as: interfacial slip that can
35 invalidate the results, disruption of plastic materials, the difficulty to load highly
36 viscous fluids or soft solids, and fiber ball up in polymeric or cementitious
37 composites [1–6]. Furthermore, the ease of execution of the method with

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