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Acid leaching resistance of composite Portland-polymeric oilwell slurries

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Abstract – Portland-based oilwell composite slurries were formulated using a solid or liquid polymeric admixture and submitted to acid leaching tests in 15% HCl. The resistance to acid leaching increased compared to plain Portland slurries. Moreover, since the effect of the acid was limited to the surface of the samples, no significant effect on the mechanical properties of the hardened slurries was noticed. X-ray fluorescence, X-ray diffraction and atomic absorption analyses revealed that HCl preferentially leached the calcium ions present in the composition of the slurries.

Heavy oils are usually found in Northeastern Brazil. Their recovery requires thermal methods such as steam injection to lower their viscosity thus improving flowing. As the inherently brittle cement sheath of an oil or gas well is submitted to thermal cycling, cracking can occur and affect the mechanical integrity of the structure [1]. The addition of polymeric admixtures to Portland-based cement slurries is an alternative to improve the fracture energy of the material, especially under thermal cycling [2]. On the other hand, the production of oil can also be stimulated by acid leaching rock formations, especially those consisting of limestone or dolomite. Weak acid solutions are injected in oilwells to open pores in the producing formation thus improving the flow of hydrocarbons. The aim of the present study was to evaluate composite oilwell cement slurries containing polyurethane after leaching in 15% HCl.

The results showed that hardened slurries containing polyurethane depicted higher resistance to acid leaching, as their mass loss in the presence of 15% HCl solution was lower comparing to plain Portland samples. Moreover, neither the compressive strength nor the hardness of the composite slurries was affect by acid leaching. This indicated that the cement matrix was not affected by the acid, which acted preferentially near the surface of the sample. X-ray fluorescence, X-ray diffraction and atomic absorption analyses (Fig. 1 and 2) suggested that calcium was rapidly dissolved in acid, especially in the polymer-free slurries. As a result, the relative concentration of Portlandite decreases, since the presence of calcium in its composition increases its solubility in HCl compared to that of hydrated calcium silicate [3]. Portland – polyurethane composites are promising candidates to be used as heavy oil wells cementing materials submitted to steam injection.

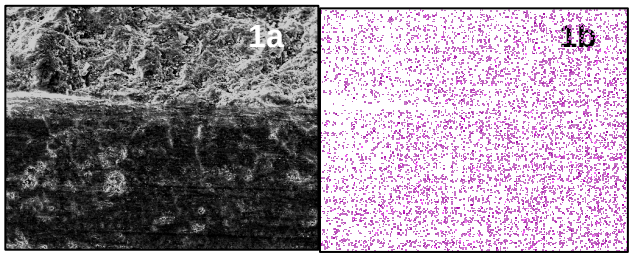

Figure 1: a) SEM image and **b)** X-ray mapping of calcium in plain cement sample after acid leaching.

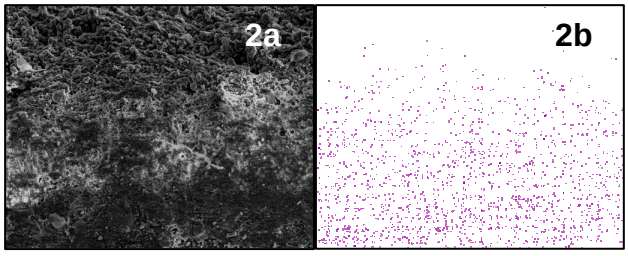

Figure 2: a) **a**) SEM image and **b)** X-ray mapping of calcium in composite cement sample after acid leaching.

References

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