



SALT DEGRADATION OF HISTORIC PORTUGUESE AZULEJOS

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ABSTRACT

Research was carried out to study the degradation of the glaze layer of a set of Portuguese tiles from the 17th and 18th centuries. The ageing action of NaCl salt has been tested on a group of tiles that presented different characteristics and defects on their glaze layer. The defects resulted from previous degradation or manufacturing faults.

The research results show that tile characteristics such as the porosity, vapor permeability, drying rate and especially the occurrence of some particular glaze defects were the most dangerous decay drivers.

KEYWORDS: Azulejos, ageing tests, soluble salts, durability, decay.

1. INTRODUCTION

From the possible forms of decay of Portuguese historical faience tiles, the most worrisome is

the detachment of the glaze layer, because it contains the pigments and thus the image without which the artistic value of the tiles is lost. The detachment of the glaze layer involves the failure of the connection between the glaze and the ceramic body, but the reasons for this detachment are still not completely understood [1]. The loss of parts of the glaze layer can also accelerate the degradation by allowing moisture to enter into the ceramic body. The most frequently mentioned degradation causes are related to the presence of water: the presence of soluble salts and biologic activity e.g. lichens.

The mechanisms of the damage caused by salts are considered to be the crystallization growth, hydration states, thermal expansion, and swelling of porous salt aggregates by moisture or

temperature [2]. These are believed to induce mechanical stresses sufficient to overcome the

ceramics mechanical strength and cause damage to the matrix [3] and to the glaze-ceramic body interface. The damage caused by salts can become manifest in several ways besides glaze detachment such as glaze blistering, tile dampness, biscuit disaggregation, tile fissuring and the less harmful salt efflorescence. The type of damage induced by soluble salts depends on the characteristics of the tiles, the type of salt that contaminates them, and the prevailing environmental conditions.

Sodium chloride is one of the most commonly encountered salts in Portuguese architectural

heritage, primarily on areas located close to the sea [4]. Whenever cyclic crystallization-dissolution occurs, strong crystallization pressures during crystal growth of sodium chloride can physically damage the ceramic materials by



disrupting their porous matrix [2]. The reason why, in the same conditions, some tiles decay while others do not is not yet completely understood. It seems, however, to be related to the occurrence of susceptible areas in the tiles caused by (local) variations of their composition and/or their physical and chemical properties. These heterogeneities could for instance have been caused by inhomogeneous raw materials, variations in the manufacturing procedure, the result of actions or degradation suffered by the tiles during their existence. Decay is also favored by some manufacturing defects [1]. Within this report we study the influence of NaCl salt degradation on a sample of 17th and a group of 18th century historic tiles (Figure 1) with different glaze defects such as delamination, pores, cracking and areas without glaze (Table 1).

2. MATERIALS (texto no Livro de Actas)

3. EXPERIMENTAL (texto no Livro de Actas)

4. RESULTS AND DISCUSSION (texto no Livro de Actas)

4.1. Water Imbibition Coefficient and Capacity

4.2. Degradation by salt crystallization

4. CONCLUSIONS (texto no Livro de Actas)

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