Impact of washed naturally formed and synthetic β-FeOOH on corrosion rate of iron as a function of relative humidity

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In high humidity βFeOOH corrodes iron in contact with it, likely due to the mobile chloride on its surface providing an electrolyte. Studies have shown that washing βFeOOH does not entirely remove chloride, which remains occluded in its crystal structure. Since occluded chloride is not mobile in water it follows that washed βFeOOH should not corrode iron in contact with it. This study reports washing naturally formed βFeOOH and synthetic βFeOOH formed by the Fe/ferrous chloride protocol using a Soxhlet wash system and by stirring in cold water until no further chloride extraction occurs. The corrosion of iron powder mixed with βFeOOH is recorded as oxygen consumption in sealed reaction vessels at 60%, 70% and 80% RH and this is compared to corrosion rates of unwashed βFeOOH at the same RH values.

Desalination methods are employed within conservation to remove chloride from archaeological and historical iron. The outcomes of this study offer insight into the impact of this washing process on the post-treatment corrosion of iron by washed βFeOOH and provides guidance on whether temperature differences during treatment will impact on the removal of surface adsorbed βFeOOH. It also offers data on the amount of chloride adsorbed onto the surface of naturally formed and synthetic βFeOOH and whether this influences the rate of corrosion of iron.