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Iron pillar and nano powder

THE IRON pillar near Qutub Minar at New Delhi is in the news, thanks to the research by Prof. R. Balasubramaniam of IIT, Kanpur and his team of metallurgists. The pillar is said to be 1,600 years old.

A protective layer of `misawite' — a compound made up of iron, oxygen and hydrogen on the steel pillar, which is said to contain phosphorus - is claimed as the reason for the non-corrosive existence.

The ab-initio layer of misawite is supposed to have developed three years after the pillar was erected. It is claimed that the layer has increased in thickness ever since. In a millennium and a half, it is calculated that this layer has grown to a thickness of 50 micron.

Presence of Phosphorus in this ancient iron — about one per cent — is due to the smelting process of iron ore using charcoal, discovered then, in this country. The pillar is dated back to the Gupta Dynasty between 320 A D and 540 A D. In comparison, modern day smelting process yields steel with only 0.05 per cent of phosphorus in it.

Dr Baldev Raj, director, Materials, Chemical and Reprocessing Groups, Indira Gandhi Centre for Atomic Research, Kalpakkam feels that this claim could be `one' of the reasons for the eternal appearance of the pillar — it needs to be confirmed. Development of such a coat at room temperature is questionable, according to him. He mentions that discoloration or multi-coloration has occurred on the outer surface of the pillar — patches of brown, blue, green and light brown are visible to his eyes. He uses a graphical display to pinpoint differing electrical potential — from the top to the bottom at different points — on the outer surface of the pillar in issue. If this is so, the layer of `misowite' which is said to be evenly spread needs to be debated. With differing potential difference along the outer surface, can a layer such as this, be even? He agrees to a suggestion that this product of technology in metallurgy cannot be a custom made one to be unique. Baldev Raj is involved in producing corrosion resistive containers for irradiating substances used in nuclear plants. For the 500 mega watt fast breeder reactor at Kalpakkam, corrosion resistant stainless steel is under study to replace carbon steel pipes. Corrosion conditions at the outer surface of materials are often totally different to that of the bulk of material, says Baldev Raj.

In this context, nano materials, where the grain size of the particle is 100 nano metres or less, can be interesting. It is well known that the physical properties of nano materials correspond neither to those of the free atoms and molecules that make up the particle, nor to those of the bulk solid of the same composition. Material made of nano powder exhibits much harder property against deformation too.

This awakens one to study nano powder of metals like steel — perhaps with phosphorus molecules — to nano-coat the surface of a steel column. This may be a solution to delay corrosion of steel. A hypothetical — almost bordering on fantasy — postulate is, whether any similar process was used on this iron pillar of Gupta period. B. G. Prakash

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