

Fabrication of Computer Memory Stores by Electrophoresis

DEPOSITION OF FERRITES ON TO PLATINUM WIRES

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In the manufacture of ferrite core assemblies for computer memories, small and accurately dimensioned rings of the ferrite must be individually threaded on to copper wires. This article describes a new technique for producing the rectangular array by depositing the ferrite on to a grid of platinum wires

The deposition of ceramics and other materials by electrophoresis is a well known technique which has been commercially exploited for over 20 years. In April 1964 discussions took place between the British Scientific Instrument Research Association and representatives of the Royal Radar Establishment concerning the possibility of using the technique for the construction of computer stores. It was postulated that the deposition of square-loop ferrite material on to a network of conductors would have the following advantages over normal methods of construction:

- (1) the laborious process of threading toroids would be eliminated,
- (2) very thin ferrite sections would be

possible, giving rise to fast switching times and lower drive currents,

- (3) it might be possible to construct a three-dimensional network of conductors, which could be coated in one operation, giving a high packing density of bits of information thereby eliminating the construction and assembly of separate planes.

As a result of these discussions a contract was placed with SIRA to explore the possibility of constructing ferrite stores by a deposition process, while in a parallel project at RRE methods were developed for investigating magnetic properties of ferrite coatings.

Electrophoretic deposition experiments were carried out in very simple types of apparatus as shown in Fig. 1, using an octanol-ethanol mixture as the electrophoretic solution. Although the process is suitable for

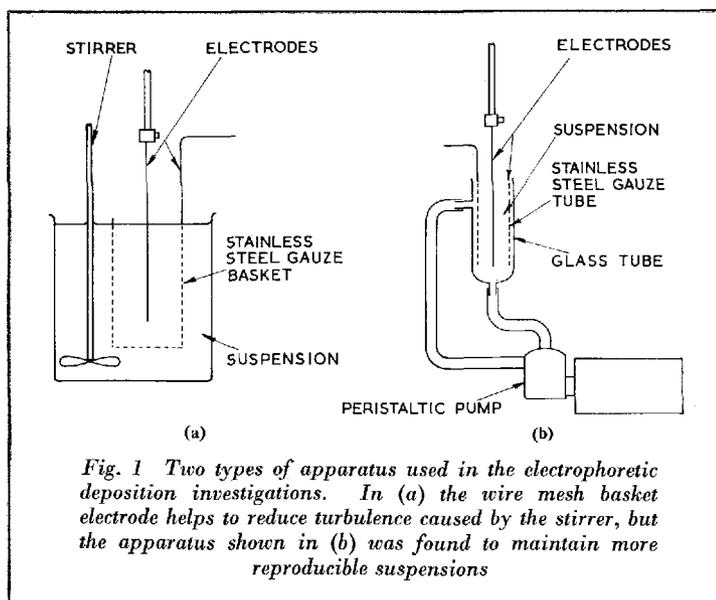


Fig. 1 Two types of apparatus used in the electrophoretic deposition investigations. In (a) the wire mesh basket electrode helps to reduce turbulence caused by the stirrer, but the apparatus shown in (b) was found to maintain more reproducible suspensions

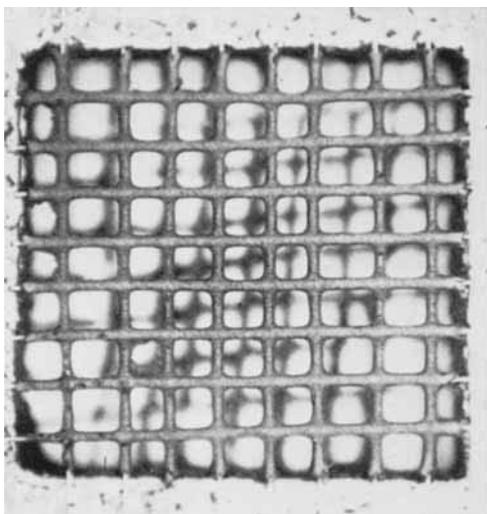


Fig. 2 An experimental 8×8 memory array made by depositing ferrite on to platinum wires

most ferrites one variety of ferrite, a magnesium-manganese-zinc type, has been used throughout this work. These materials have to be sintered at temperatures between 1350 and 1400°C to give the requisite square-loop characteristics, and this naturally imposes limitations on the conductors used; in practice pure platinum or rhodium-platinum alloys have been employed.

In the initial experiments single 0.015 inch diameter wires were coated with ferrite and fired to give the requisite square-loop characteristics.

Subsequently, experimental 8×8 arrays of devices have been constructed by winding 0.005 inch wires on to small platinum jigs and then coating the whole with ferrite material as illustrated in Fig. 2. This was done by deposition, the space between the wires at each cross-over position being filled with ferrite so that the two wires then became embedded in ferrite, thus forming an array of 64 miniature BIAX elements. These elements have been shown to operate successfully as a non-destructively read storage device using a two-wire ratchet write system, with read times as short as 0.05 μs. Similar elements have also been operated in a toroidal destructive mode with read times of 0.5μs.

Another interesting development is the fabrication of a ferrite-coated wire memory store of similar construction to the alloy-plated wire system. This storage system shows considerable promise and is unlikely to suffer from the difficulties that are currently encountered with the alloy-plated wire system. Since ferrite can be deposited round any shape of electrode and the amount deposited controlled by varying the deposition conditions, desirable element shapes which have previously been thought to be uneconomic may well prove to be easily fabricated by this process. Because of the inherent simplicity of the process the problem of yield may well be less severe than for other batch fabrication processes.

Oxidation and Reduction by Transition Metal Complexes

A symposium entitled "Oxidation and Reduction", organised jointly by the Chemical Society and the Royal Institute of Chemistry, was recently held in London as a part of the latter body's Annual Conference. In the course of this symposium, Dr Bernard Shaw of Leeds University reviewed the application of transition metal complexes in oxidation and reduction reactions.

Dr Shaw explained that the ability of such complexes to act catalytically arises from the fact that the metal atom can assume various valencies and co-ordination numbers. There are large differences between the strength with which, for example, olefins are co-ordinated to metal atoms; this binding strength increases from Ni^{II} to Pd^{II} to Pt^{II}, but the reason for this is not well understood. By decreasing the metal's valency, more electrons are made available for back-donation to the olefin, and a stronger bond results.

Optimum catalytic reactivity results when an olefin is neither too strongly nor too weakly bound to the metal atom: hence Pd^{II} complexes are most suitable for oxidation processes. Since Pd^{II} complexes are easily reduced, Rh complexes are more suitable for reductions, and the ready ability of Rh^I to be oxidised to Rh^{III} is of great importance in these reactions.

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