Prospect in Ferrocement Materials, Applications, and Technology†

A. E. Naaman*

Let us take a giant step through the history and development of ferrocement, from the ferrocement of Lambert to today's ferrocement, and let us explore the future prospects of ferrocement starting by its very definition.

While we are used to thinking of ferrocement as a type of thin-wall concrete reinforced with closely spaced layers of meshes, some recent large-scale applications of ferrocement use large size meshes in combination with high strength reinforcing bars, steel fibers, and prestressing, leading to wall thicknesses larger than 50 mm. They seem to span the range between what is today considered ferrocement and traditional reinforced concrete.

Describing these structures as ferrocement structures may be questioned strictly on the basis of its definition. However, the current trend is a healthy one. It really shows that ferrocement is one extreme boundary of reinforced concrete and that the whole range between them should also be explored. Perhaps ferrocement should be simply seen as a system of reinforced concrete construction with reinforcement distributed throughout the depth of the member. Improved elasticity, cracking, extensibility and impact characteristics are achieved by proper control of the reinforcement parameters.

While ferrocement can benefit (code and specification wise) from its being considered an extreme boundary of reinforced concrete, it has and still is taking advantage from rapid developments in the field of composite materials including advanced composites.

By concrete standards, ferrocement can be thought of as a thin reinforced concrete construction with very high performance characteristics such as high-tensile strength, ductility, and impact resistance. While these characteristics are required for marine applications, they are not always necessary for building construction. This is leading to modifications of the traditional ferrocement technology.

One of the main factors that has so far hindered the full development of high performance ferrocement is its cost. The relatively high cost of ferrocement, in comparison to reinforced concrete, is mainly due to the labor intensive nature of its fabrication and at least equally, to the cost of the mesh system. Some recent studies have shown that even in the U.S. the cost of the reinforcement in high performance ferrocement is larger than the cost of labor. On an equal weight basis, the cost of steel mesh varies from 2.5 to 8 times that of conventional reinforcing bars.

There is, however, increasing evidence that even in industrialized countries, ferrocement can be cost competitive through mechanized fabrication and the proper choice of mesh reinforcement. For instance a factory produced ferrocement element using shotcreting instead of

† Special lecture given during the Second International Symposium on Ferrocement, 14-16 January 1985, Bangkok Thailand.

* Professor of Civil Engineering, The University of Michigan Ann Arbor, Michigan 48109 U.S.A.
In summary, most experts and users agree that, in all respects, Ferrocement is an excellent construction material of the future. However, in spite of its many significant advances in the last ten years, which are in great part due to the existence of a critical point in development, it is hoped that the crucial support of various organizations in the center of the point will continue, and I hope that you and I will be around to witness the worldwide success of a magnificent achievement.

We are witnessing a considerable evolution in materials and techniques. At the reinforcement level, where steel remains the primary reinforcing material, other materials such as fiberglass meshes and synthetic fibers have been tried. The integration of organic materials (cellulose, rubber, fabric) to steel remains a probability that will be further explored. Further savings can be achieved when the matrix or the reinforcement is mechanically applied as a thin layer.