Material Characteristics of Polymer Concrete

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The demand for a lighter and a stronger construction material has focused attention on a type of composite material called polymer concrete. Polymer concrete is formed by polymerizing a monomer with an aggregate. The polymerized monomer acts as a binder for the aggregate reinforcement. In comparison with conventional portland cement concrete, this unique composite material offers a number of advantages, such as higher strength, better chemical resistance, and higher impermeability. The present work represents a major contribution to resolving issues related to the use of polymer concrete as a wear surface on a composite bridge deck.

Three different resin systems were examined for their use as a matrix material. Materials selection involved an extensive investigation of properties, such as glass transition temperature, elastic modulus, and coefficient of thermal expansion.

Combining Rules for particulate composites were used to develop a model for predicting the thermoelastic properties of multiphase composite systems. The model incorporated the effect of entrapped voids while predicting the thermoelastic properties. Polymer concrete samples of different composition were tested for their elastic modulus Poisson's ratio and coefficient of thermal expansion. The experimentally derived properties compared favorably with the model predictions. The effect of the size of the reinforcing phase on the properties of the composite material was also examined.

The effect of matrix selection and the cure history on the durability of polymer concrete were investigated. Samples of polymer concrete were exposed to water, selected motor fluids, and freeze thaw cycles. Particular attention was paid to the mechanisms which caused degradation. The results obtained indicated that the property loss associated with exposure to fluids was mainly due to interfacial degradation. Thus attempts were made to improve the interfacial characteristics of polymer concrete using silane coupling agents. **A** styrl amine functional coupling agent was used for this purpose, and the results suggest significant improvement of interfacial behavior and retention of properties after exposure to water.

This work provides a scientific base for future studies aimed at optimizing material selection and processing conditions for polymer concrete in wear surface applications.