

# **Toward Green Concrete for Better Sustainable Environment**

*Author(s)*

**Bambang Suhendro**

*Department of Civil and Environmental Engineering, Universitas Gadjah Mada, Yogyakarta, Indonesia*

*Abstract*

Eight to 10 percent of the world's total CO<sub>2</sub> emissions come from manufacturing cement. The global warming gas is released when limestone and clays are crushed and heated to high temperatures. Green concrete is defined as a concrete which uses waste material as at least one of its components, or its production process does not lead to environmental destruction. Various efforts have been conducted by researchers to arrive at some alternatives that are able to significantly reduce high energy consumed and environmental impacts during fabrication process of cement, including implementing the concept of industrial ecology and green chemistry as well as nanoengineering that study the behavior of the structure and organization of nanoparticles of cement in the mix for achieving higher performance. The cleaner technologies in concrete production, such as substituting relatively high percentage of cement by fly ash (upto 100%), the use of other natural pozzolans, development of concrete with recycling or waste materials, and developing nanoconcrete by integrating CNT's or self sensing CNT's in the concrete mix for higher performance in terms of strength, stiffness, and durability, have been developed and are addressed in this paper. Several efforts that have been done so far in implementing the concept of green concrete and material development of nanosilica in Indonesia is discussed. Finally, problems in the realization of and potential barriers to green concrete as well as political scenarios that have been adopted by several countries through implementation of various priority and deregulation in various fields are also discussed.

**Keywords** : green concrete, nanosilica, nanoconcrete, CNT's, fly ash, recycling, alternative aggregate