

综述

## Multi-scale Approaches toward Sustainable Development

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**摘要** Approaches toward the sustainable development need integrated considerations of technical, economical, environmental/ecological and social issues. Current approaches from different disciplines can be grouped into at least three levels: micro-scale, meso-scale and macro-scale. At the micro-scale, green chemistry carries out chemical activities such as chemical design and synthesis so that environmentally benign chemicals can be synthesized without using and generating hazardous substances. Green engineering, at the meso-scale, develops green industrial processes or clean technologies via pollution prevention and cleaner production, which will cause minimal damages or dangers to the environment and ecosystems when the product is manufactured and used. Industrial ecology at the industrial complex or community level seeks to optimize energy and materials use and minimize waste generation in industrial systems or communities by promoting planned materials and energy exchanges. Incorporation of ecological principles with the life cycle thinking in the chemical pathway synthesis, product design, process development, and industrial system and community planning appears to be the most promising engineering approach in achieving sustainable industrial development.

**关键词** [sustainable development, green engineering, pollution prevention, cleaner production, industrial ecology, multi-scale approaches, complex systems](#)

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