Sustainable Engineering Research Cluster

Sustainability occurs when we maintain or improve the material and social conditions for human health and the environment. It is a challenge for scientists and engineers in designing processes and products to achieve sustainability. Therefore, UniMAP had established a sustainable engineering cluster focusing on research of materials recycling. Modern technologies and manufacturing of the consumer products impact our societies in a variety of ways, some are positive and others are adverse. Materials play a crucial role in this technology-economy-environment system. Materials are utilized to produce consumer products which are later discarded through several stages. These stages are represented in Figure 1, the "total materials cycle". The extracted raw materials are then purified, refined, and converted into bulk forms such as metals, cements, petroleum, rubber, fibres, and many others.

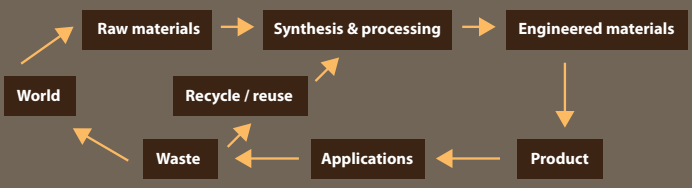

Figure 1 : Total Materials Cycle

The bulk forms then produce "engineered materials", such as metal alloys, ceramic powders, glass, plastics, composites, semiconductors and elastomers. These are then shaped, treated, and assembled into products, devices, and appliances for the consumer. Upon purchasing these will be discarded later.

Here the product constituents may either be recycled or disposed of as waste. Energy is a resource that is limited in supply and measures must be taken to conserve and utilize it more effectively in the production, application, and disposal of materials. The condition of the earth's atmosphere, water, and land depends to a large extent on how carefully we tread this materials cycle. Some ecological damage and landscape spoilage undoubtedly result during the extraction of raw materials phase. Pollutants may be generated that are expelled into the air and water during the synthesis and processing stage; in addition, any toxic chemicals that are produced need to be disposed of or discarded. The final product, device, or appliance should be designed such that during its lifetime, any impact on the environment is minimal; Furthermore, at the end of its life that, at best, provision be made for recycling of its component materials, or at least for their disposal with little ecological degradation (i.e., biodegradable).

CLUSTER OBJECTIVE

The objective of this research cluster is to develop processing techniques or useful materials from a sustainability perspective including economic (eg-energy consumption), value addition, environmental and social aspect.

RESEARCH SUB-CLUSTERS

The cluster is based on developing strong expertise and facilities in seven priority areas: Metallurgy, Construction Materials, Materials Chemistry, Electronic Materials Polymer, Plant and Process Design, Ceramic

FUTURE RESEARCH ACTIVITIES

a) To develop tools, methodologies and technologies in the development of sustainable materials.
b) To develop sustainable processing of materials based on low and high temperature including recycling activities.
c) To identify opportunities and barriers for knowledge transfer relating to sustainability.
d) To develop Industry-University interaction in the innovation of new tools, methodolo gies and technologies.

RESEARCH FACILITIES

a) **Characterization Laboratory :**
Scanning Electron Microscope (SEM), X-Ray Diffraction (XRD), Light Microscope (LM), Differential Scanning Calorimetry (DSC), Thermogravimetry Analyzer (TGA).

b) **Processing Laboratory :**
Crusher , Grinder, Pulverizer, Muffle Furnaces, Tube Furnaces, Hot Press, Casting Unit, Concrete Mixer, Powder Press.

c) **Properties Testing :**
Gotech Universal Testing Machine (50 tones), Instron Universal Testing Machine (5 tones), Brinell Hardness, Vickers Hardness, Micro-Knoop Hardness, Rockwell Hardness, Torsion Tester, Fatigue Tester, Impact Tester, Density Balance, Resistivity Meter, Eddy Current.

CONTACT

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