Editorial[1]

The inside story behind materials engineering

Materials engineering is a fascinating branch of engineering and has glorious past to its credit as well as a bright future ahead. Historical eras have been named after various materials which were being used in that era. Stone age, bronze age, iron age, plastics age and composites age are to name a few. Presently we are in the era of smart materials.

The comforts of life would not have been possible but for the researches and development of new materials. Light materials made it possible to have satellites without which there would not be any of the modern communication and transportation services. Newer electronic materials have made faster and smaller computers possible. Fighters, bombers, rockets, missiles etc. are all possible because of the development of newer and lighter materials. We still do need even more lighter materials to go for hypersonic planes from supersonic planes.

Materials have made tremendous inroads in biomedical applications too. A number of bio-metals, biopolymers and bio-ceramics are being used for making various prostheses. Hip prosthesis, knee prosthesis, elbow prosthesis, ankle prosthesis, wrist prosthesis etc. are being commonly used employing all these engineering materials. They are also being used for implant applications such as dental implants, orthopaedic implants and implants for bridging large osteoperiosteal gaps. Biomaterials are also being used for making fracture fixation plates, intra-medullary nails and interlocking screws besides being used for ophthalmic applications, cardiovascular applications, as suture materials, for drug delivery systems and tissue connectivity etc.

Materials research area is also very interesting indeed and one seeks answers to certain basic questions. For example, we all know that due to fatigue, materials fail at much lower loads than they should and the question arises as to why fatigue should occur at all. After thoroughly investigating the phenomenon, one realizes that due to push-pull loading or flexural loading, stresses change from tensile to compressive and back to tensile. Hence if during tensile loading, plastic deformation takes place near micro-defects due to stress concentration, the deformation is permanent elongation and this permanent elongation cannot be undone during compressive cycle where the loading cycle tries to permanently compress the body. Due to this mismatch, fatigue crack nucleates and starts

propagating in subsequent cycles. Similarly, when you tear a paper or break a twig, you hear some sound. Where does this sound come from? Sound is a form of energy and it cannot be produced. We can only change one form of energy to the other form. Hence some energy form must be getting converted into sound energy. On thorough investigation, one finds that every materials has stored elastic energy within the volume of material which get released on plastic deformation, phase transformation or fracture. There are several such questions and which would always be investigated by materials scientists to keep the material research going and resulting in development of newer materials and newer technologies. The future of materials engineering is very bright indeed.

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