DEGRADATION OF ENGINEERING MATERIALS - IMPLICATIONS TO REGENERATIVE MEDICINE

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In engineering, degradation is defined as a loss of the relevant properties of materials which proceeds gradually due to exposure to in-service conditions. Among the factors enhancing the degradation of engineering materials one can distinguish: elevated temperature, irradiation, mechanical loading (in particular friction) and aggressive environment. Some of these factors, e.g. temperature act over entire volume of components and bring about volumetric changes in the microstructure. The degradation caused by environmental impact is usually limited to the near-surface zone and includes such processes as corrosion, oxidation, atom absorption and diffusion.

Industry pays an enormous price for material degradation. Materials degradation problems are in particular important in marine environments, oil and gas production, and energy conversion and generation systems, including fossil and nuclear. In response to these challenges the extensive research programmes have been carried out which resulted in a number of now well developed techniques for monitoring the degradation of materials of industrial installations.

Human body can also be considered as one of the in-service environments for engineering components. In fact, the degradation of biomaterials is one of the most relevant issues in the field of regenerative medicine. In industrial practice, the degradation is always a negative phenomenon (except of biodegradation of the waste). In bioengineering, the degradation may be undesirable (e.g. corrosion of metallic implants, wear of artificial joint implant) or desirable (biodegradable devices and tissue engineering). In both cases, the knowledge of the kinetics of degradation is crucial for safe use of biocomponents. The methods for predicting remaining life commonly used in industrial practice will be presented in the context of biomaterials. Non destructive techniques for monitoring degradation will be discussed and some ideas about their application to bio-environments proposed.