IIT-Hyderabad developing tech for bio-compatible implants

SPECIAL CORRESPONDENT

To help in early detection of malfunction, avoid reverse surgery

Researchers at the Indian Institute of Technology, Hyderabad (IIT-H) are developing new technologies for bio-compatible implants that will enable early detection of malfunctions through non-invasive monitoring and diagnosis. Early detection of premature failure or malfunctioning prosthetic implants without surgery can help patients avoid reverse surgery, a remedial measure more expensive and painful than first time surgery.

Eco-friendly material

For this purpose, a bio-compatible implant with sensing property and high hardness will be the best choice.

The piezoelectric/ferroelectric material can detect change in the mechanical energy due to its dimensional change during the functional period.

To avoid the reverse surgery, an eco-friendly and hard ferroelectric material can be effective choice as an implant instead of other available ceramic or steel-based implants.

Researchers have shown that reducing particle sizes of the ferroelectric material results in improvements in mechanical properties without compromising on their electric characteristics, making them suitable for bio-compatible implants.

Their work has recently been published in the Journal of American Ceramic Society. The study is being led by Saket Asthana, head professor, Advanced Functional Materials Laboratory, Department of Physics, IIT-H.

His team is studying lead-free ferroelectric ceramics for use in orthopaedic implants.

“Most importantly, this eco-friendly material is synthesised by normal solid state reaction method instead of sophisticated technique, which may reduce the cost of processing of this material. This finding can show the pathway of using this kind of ceramics in prosthetic applications; the piezoelectric property makes them detectable from outside, which enables non-invasive monitoring and diagnosis. An extensive research in collaboration with medical team is necessary to come with real time and practical application of these materials,” said Dr. Asthana.

“Piezoelectric and ferroelectric ceramic materials have the potential to be used in prosthetic implants, but the benefit of electrical stimulation is offset by poor mechanical properties like hardness and toughness,” Dr. Saket said adding that many piezoelectric materials contain lead, which is toxic and is banned by most countries in the world.

There is, thus, a quest for lead-free piezo and ferroelectric ceramics for a range of applications, including biomedical.

The improvement of mechanical properties of lead-free ceramics without compromising on the ferro/piezoelectric properties has been challenging.

Dr. Asthana’s team meets this challenge through materials engineering; the researchers reduce the particle sizes of lead-free ferroelectric powders before compacting them into solid items to improve the mechanical properties of the ceramics.

Source: The Hindu

Date: 02/07/2019