Editorial

Shape Memory Materials for Medical Devices

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Because of their unique shape memory properties and good bio-compatibility, shape memory materials, both alloys and polymers, are potential candidates for medical devices, in particular, as the operational devices for minimally invasive surgery. In recent years, we have witnessed great progress in the development of shape memory materials based new medical devices, which provide novel and compact solutions to many problems in practices, which cannot be easily handled by traditional designs using conventional materials.

This supplement of The Open Medical Devices Journal not only reports some recent progress in the applications of shape memory materials for medical devices, but also includes a brief review of a book about thin film shape memory alloys, which has been published by Cambridge University Press in September 2009.

In this supplement, the history of shape memory alloys in medical applications is reviewed, together with the most recent development. As we can see, many difficulties can be easily tackled if shape memory materials are used. This is further evidenced by a few applications of NiTi shape memory alloy, one for an osseointegration trans-femoral implant, one for transanal endoscopic microsurgery, and one for self expanding stents to treat peripheral vascular disease. In all cases, shape memory alloys provide an ideal solution to a problem that traditional approaches have difficulty to handle.

The number of applications of shape memory polymers has increased dramatically in recent years. While the recoverable strain on an order of 100%, which is well over that of shape memory alloys (normally less than 10%), is the most attractive point, good bio-compatibility and the possibility to be bio-degraded even in a well-controlled fashion are other advantages more of the concern in biomedical applications, together with the flexibility in triggering shape memory by other stimuli (e.g., moisture, light, magnetic field, pH value) in addition to heat as in NiTi shape memory alloys. Potential applications in novel medical devices of a polyurethane thermo-moisture shape memory polymer are discussed in this supplement. The advantages of shape memory polymer foams as self-deployable vascular and coronary devices for endovascular treatment are elaborated.

Apart from these technical papers, a review of one recent book entitled Thin Film Shape Memory Alloys has been included, which reveals a new dimension for the medical applications of shape memory materials at micro scale. It may provide an important driving force for the development of cellular surgery as a next step of medical operation beyond the current minimally invasive surgery using an advanced thin film, MEMS and micromachining technologies.

A nice marriage of shape memory materials and medical surgery has resulted in many novel medical devices, which are beyond our imagination a few years back. We wish this supplement, which presents a few typical examples for both shape memory alloys and polymers, could inspire more technical applications to be realized.

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