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Flagellated bacterial robot for drug delivery system

Zhenhai Zhang and **Xudong Liu**
Beijing Institute of Technology, China

One of the primary goals of biomedical micro-robot technology is to reach currently inaccessible areas of the human body and carry out a host of complex operations. Potential targeted medical applications for these micro-robots include highly localized minimally invasive surgery, drug delivery, and screening for diseases at their early stages. Recent developments in micro- and nano-scale engineering have led to the realization of various miniature mobile robots. However, two of the most significant obstacles are the miniaturization of the on-board actuators and power sources required for fabricating high-mobility devices. Bio-motors are deemed to be one of the most promising choices for actuation. They have many advantages over man-made actuators, mainly because they are much smaller and are capable of producing more complicated motions. More importantly, they convert chemical energy to rotational energy. A number of liposomal drugs have been approved or are under development for human use. There are a number of obstacles to optimizing their use, such as delivering them rapidly to the intended target. Biological micro-robots would seem to serve as potentially excellent devices for this purpose. Here, we propose a system for the miniaturization of bio-mimetic propulsion, which links motile bacteria to liposomes by means of an antibody. The research presented here aimed to investigate the stochastic nature of bacterial propulsion of liposomes, which is important for developing next-generation bio-hybrid swimming micro-robots for applications in diverse fields ranging from biomedical to environmental applications.

zhzhang@bit.edu.cn

Innovative technologies of the frozen body strength increase during shaft sinking

Ibragim Palankoev
Moscow Institute of Steel and Alloys, Russia

We considered the process of dynamic impact of blasting waves on the strength of the frozen body and on the freezing columns tightness. We improved the design diagram of frozen body strength, by taking into account weakening of the frozen rock massif on the circuit of frozen boreholes. We proposed a patented method of increasing the strength of annular clay mortar by pumping of the polypropylene fiber in drilling fluid in ratio of solid and liquid phase 9:1 during final stage of drilling. In this connection, strength of frozen clay mortar rises to 7 MPa. The results of studies of ice wall strength in conditions of Gremyachinskoe deposit (Russia) will be also presented in the work.

mishkenzia@gmail.com