Antibacterial functionalization of stainless-steel via LIPSS control using a femtosecond laser

Mikuru Okazaki[1*], Masaki Hashida[2,3], and Satoru Iwamori[2]

[1] Course of Science and Technology, Tokai University, 4-1-1 Katakana, Hiratsuka, Kanagawa 259-1292, Japan
[2] Research Institute of Science and Technology, Tokai University, 4-1-1 Kitakaname, Hiratsuka, Kanagawa 259-1292, Japan
[3] Institute for Chemical Research, Kyoto University, Gokasho, Uji, Kyoto, 611-0011, Japan
*Corresponding author email: 3mtad003@mail.u-tokai.ac.jp

Recent studies have demonstrated that antibacterial properties can be imparted by creating nanopillar-like microstructures[1] and periodic structure[2] inspired by biomimetics. Therefore, we focused on laser processing. Figure 1 shows experimental setup. This method enables the formation of microstructures on various materials through a simple process and has the potential to be applied to existing products.

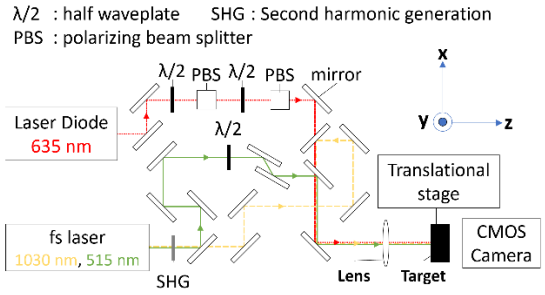

Fig 1 Experimental setup for LIPSS formation

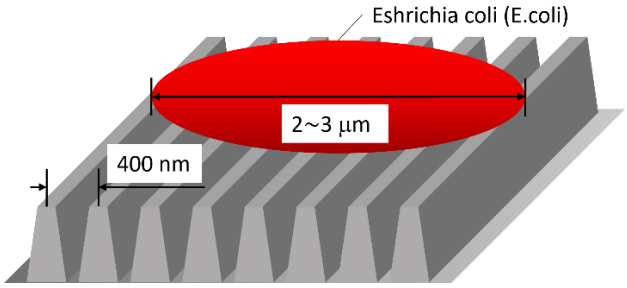

Fig 2 Schematic Diagram of LIPSS and E.coli

In this study, we formed laser-induced periodic surface structures (LIPSS) by irradiating a stainless-steel surface perpendicularly with a pulsed second laser and conducted antibacterial tests (JIS Z 2801).
As a result, the LIPSS with an average interspace of 700 nm exhibited 20% antibacterial efficacy, whereas that with an interspace of 400 nm demonstrated 80% efficacy. This indicates that antibacterial performance is related to the interspace and the uniformity of the periodic structure. A similar trend has been observed in surface topographies formed by Fine particle bombarding (FPB)[3]. In our presentation, we will discuss the investigation of conditions that enhance antibacterial performance.

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