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Program and Abstracts

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Plasma immersion ion implantation (PIII) circumvents the line-of-sight restriction imposed by conventional ion beam ion implantation (IBII), and has been shown to be an effective surface treatment technique for industrial components, especially those possessing an irregular shape. Gears are widely used for rotary motion in various industrial machines. Industrial gears, mostly made of steels processed under various heat treatment conditions or nitrided steels, require high surface hardness, good wear resistance and excellent fatigue properties. The working surface of a gear is its tooth surface, and so a gear has a complex shape. PIII is a good method to improve the surface properties of a gear. In this work, we focus on the PIII treatment of real spur gears. Argon and nitrogen PIII was conducted on the gear surface and the implant uniformity along the gear surface was investigated. Rutherford backscattering spectrometry (RBS) was used to determine the implanted ion dose along the gear surface using silicon pieces affixed at different positions. The results show that the lateral difference is quite large but the ion dose distribution along the gear surface for argon and nitrogen is almost the same. We have also found a large iron content on the silicon surface at some positions, which corresponds to the degree of sputtering near this position and also reflects the ion implantation angle and energy. In this paper, we will discuss the distribution of the sputtering angle along the gear surface, especially along the tooth surface and contaminants such as oxygen.