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**Temperature Dependence of Nitro-Quenching by Atmospheric-Pressure Plasma** MASAKI MITANI, RYUTA ICHIKI, YUTARO IWAKIRI, SHUICHI AKAMINE, SEIJI KANAZAWA, Oita University — A lot of techniques exist as the hardening method of steels, such as nitriding, carburizing and quenching. However, low-alloy steels cannot be hardened by nitriding because hardening by nitriding requires nitride precipitates of special alloy elements such as rare metals. Recently, nitro-quenching (NQ) was developed as a new hardening process, where nitrogen invokes martensitic transformation instead of carbon. NQ is adaptable to hardening low-alloy steels because it does not require alloy elements. In industrial NQ, nitrogen diffusion into steel surface is operated in high temperature ammonia gas. As a new technology, we have developed surface hardening of low-alloy steel by NQ using an atmospheric-pressure plasma. Here the pulsed-arc plasma jet with nitrogen/hydrogen gas mixture is sprayed onto steel surface and then water quench the sample. As a result, the surface of low-alloy steel was partially hardened up to 800 Hv by producing iron-nitrogen martensite. However, the hardness profile is considerably non-uniform. We found that the non-uniform hardness profile can be controlled by changing the treatment gap, the gap between the jet nozzle and the sample surface. Eventually, we succeeded in hardening a targeted part of steel by optimizing the treatment gap. Moreover, we propose the mechanism of non-uniform hardness.

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