

Abstract Submitted
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Optimization of Etching Recipe Using Reinforcement Learning

HYAKKA NAKADA, TATEHITO USUI, TAKESHI OHMORI, Hitachi, Ltd. Research Development Group — As the semiconductor devices have changed from 2D to miniaturized 3D structures, the process development period has been increased. The long development period has caused the device cost to increase. In etching processes, the number of steps of a recipe, which is a set of etcher parameters for plasma conditions, has increased beyond 10. Rapid optimization of multi-step recipes to obtain target profiles is required to reduce the development period. In our previous study, a recipe-exploration method utilizing machine learning was developed to optimize single-step recipes [1]. In this method, supervised learning was utilized to learn the non-linear relationship between etching profiles and recipes. However, they are considered to require a large number of learning data because the number of recipe parameters increases as the number of steps increases. In this study, we developed a data-efficient method to optimize multi-step recipes with reinforcement learning, which is specialized for optimizing a plurality of operations [2]. We succeeded in real-time control of multi-step recipes during the plasma process to etch the target profile. [1] H. Nakada, et al., GEC2017, [2] D. Silver, et al., Nature, vol. 529, pp. 484-489 (2016)

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