Extreme Ultraviolet Interference Lithography toward 1X nm Nodes

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1. INTRODUCTION

Extreme ultraviolet lithography (EUVL) will be used for the 22 nm node in the high volume manufacturing of the semiconductor electronics devices. In addition, according to the ITRS, EUVL might be used in multi-generation toward 11 nm node. However, there is no exposure tool to be able to replicate 11-nm-width resist pattern in stable. Therefore, exposure tool of EUV interference lithography (EUV-IL) has been developing. The fabrication of the transmission grating is a key technology in EUV-IL. To obtain a fine-grating pattern less than 40 nm L/S with a high contrast, the novel fabrication processes were introduced. And utilizing the fabricated transmission grating, we succeed to replicate 17.5 nm L/S resist pattern.

2. EXPERIMENTAL

In EUV-IL, two luminous flux of EUV light which were diffracted by two window transmission grating was utilized in the EUV-IL. Thus, since a half pitch size of the transmission grating pattern can be replicated on a wafer, the fabrication of the transmission grating with a fine pattern is a key technology. Figure 1 shows the fabrication process of the grating. In the fabrication of the transmission grating pattern less than 40 nm L/S pattern, the replication of the fine resist pattern by EB process, the SiO_2 hard mask process and the center stop process were applied.

3. RESULTS

Figure 2 shows the photograph of the fabricated grating. Appling the advanced processes in the fabrication of the transmission grating, 35 and 30 nm L/S transmission grating patterns were fabricated. In addition, as shown in Fig.3, using the transmission grating 20 and 17.5 nm L/S resist patterns were fabricated on a wafer.

4. CONCLUSIONS

35 and 30 nm transmission grating patterns for 1X nodes were fabricated. And 17.5 nm L/S resist pattern was replicated on a wafer. It is demonstrated that the EUV-IL has a capability to replicate 1X nm for the resist evaluation.

5. ACKNOWLEDGEMENTS

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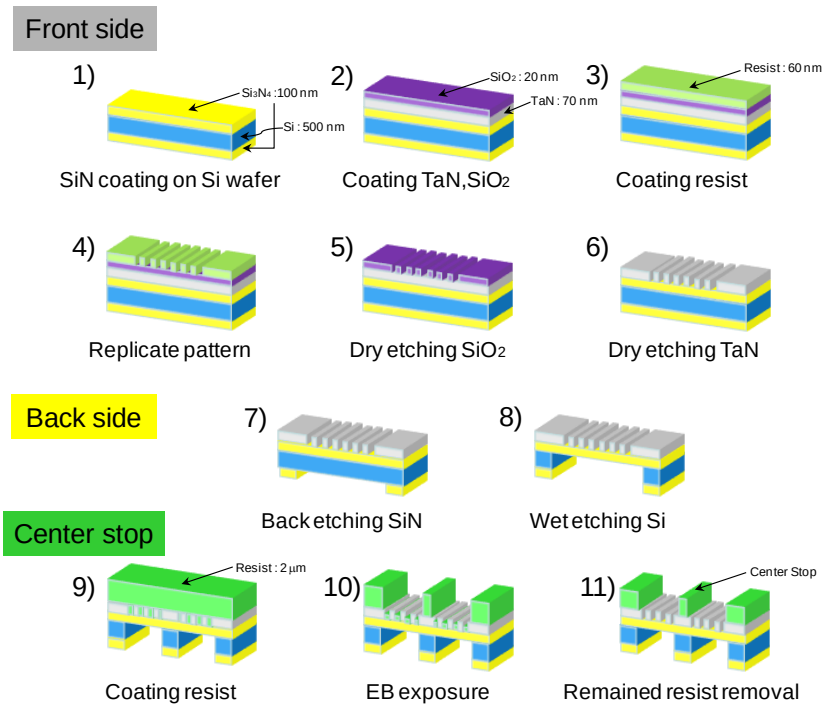

Figure 1: Fabrication process of a transmission grating.

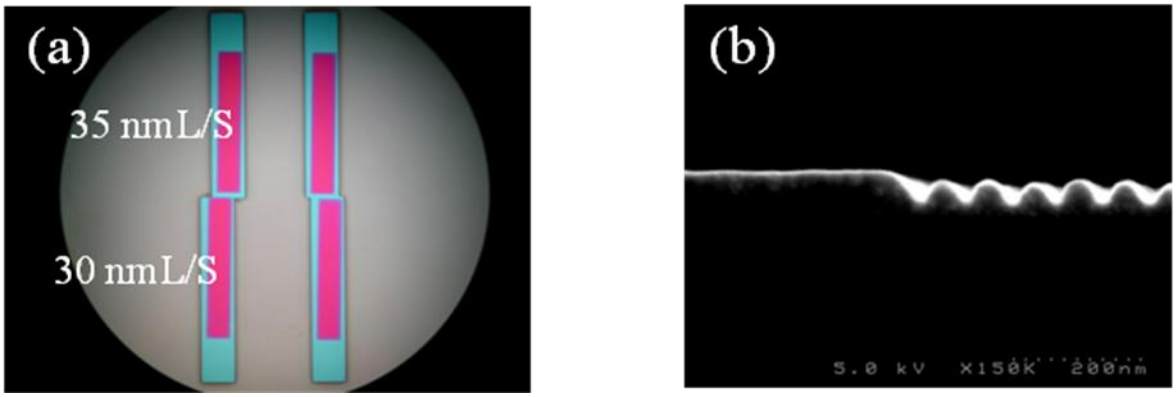

Figure 2: (a) Optical microscope image of transmission grating. (b) SEM image of 35 nm L/S TaN pattern.

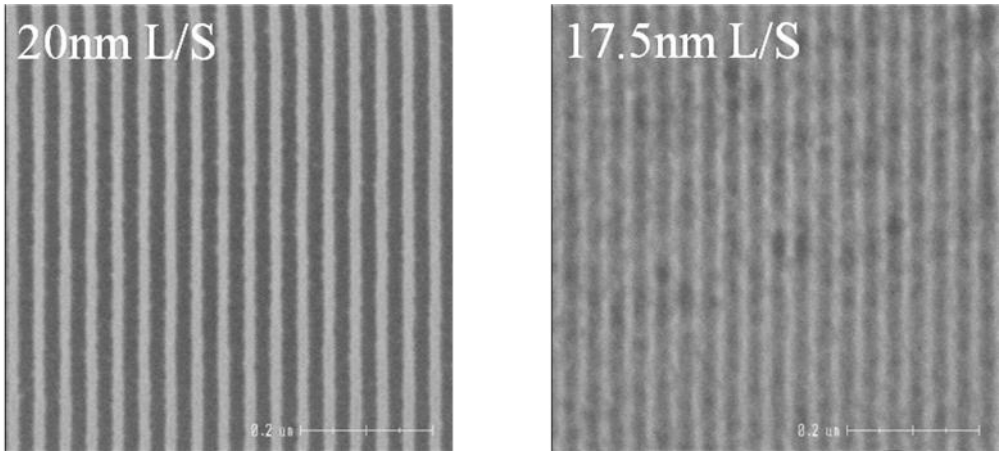

Figure 3: SEM images of 17.5 nm and 20 nm L/S resist patterns.