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Infinitely high selective etching of ITO to Ru in ITO binary mask structure for extreme ultraviolet lithography (EUVL) in inductively coupled Cl_2/Arplasmas

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According to the roadmap for optical lithography, patterning below 45nm is needed from the year 2010. One of the most promising technologies to print these structures is EUV lithography (EUVL). EUVL is one of the options for 32nm half-pitch patterning and provides also extendibility to 22nm node. Among the core EUVL technologies, mask fabrication for EUVL is of considerable importance due to the use of new reflective optics having a completely different configuration compared to those of conventional photolithography. This study investigated the etching properties of EUVL binary mask structure including newly proposed absorber layer of ITO, Ru (capping/ etch-stop layer), and Mo-Si multilayer (reflective layer) by varying the gas flow ratio, dc self-bias voltage (V_{dc}) and etch time in Cl_2/Ar inductively coupled plasmas. ITO absorber layer needs to be etched with no loss of Ru layer on the Mo-Si multi layer for fabrication of the EUVL ITO binary mask structure proposed here. The ITO layer could be etched with an infinitely high etch selectivity over Ru etch-stop layer in Cl_2/Ar plasma sat an optimized etch condition even with increasing over etch time.