

ABSTRACT

PATTERNING PROCESS

Process for forming a pattern without damaging substrate. It includes forming an organic underlayer film, a tin-containing middle layer film, and an upper layer resist film on a substrate; forming an upper layer resist pattern; transferring the upper layer resist pattern to the middle layer film, and forming an organic underlayer film pattern on an upper portion of which a portion of the tin-containing middle layer film is left; removing portion of the tin-containing middle layer film by dry-etching; forming an inorganic silicon-containing film so as to cover the organic underlayer film pattern; exposing the upper portion of the organic underlayer film pattern; removing the organic underlayer film pattern to form an inorganic silicon-containing film pattern with a pattern pitch that is $1/2$ of the upper layer resist pattern; and processing the substrate while using the inorganic silicon-containing film pattern as a mask to form a pattern in the substrate.

[Fig. 1]