Etching Characteristics of Fe_3O_4 Thin Film for Absorptive WGP with 45 nm Line and Space Pattern Fabricated by Nano Imprint Lithography

Y.T. Cho, J.H. Kim, Y.J. Kim, Y.H. Jeong and Y.G. Jung
Department of Mechanical Engineering, Changwon National University, Republic of Korea
ytcho@changwon.ac.kr

Polarizer is very important element in the display industry and most of the polarizer is composed of PVA/TAC film which absorbs light. However thickness of the conventional polarized film is about 150µm, so it is very difficult to apply to next generation display such as rollable and bendable display. As the nano patterning technique is developed, it is possible to make the ultra-fine pattern and to reduce the thickness of the wire grid polarizer (WGP) up to 1 µm or less. Also, WGP which has a high luminance and light efficiency is researched to replace the conventional polarized film. WGP has the characteristic to reuse the reflected light in a grid pattern, but existing film has absorbing the light against the WGP. Therefore, in this study, we suggest new structure for absorptive WGP by deposition of absorptive material and introduce the fabrication process including nano imprint lithography.

To exchanging conventional polarized films, the extinction ratio of the WGP should be at least over 2000:1. By the simulation, the size of the optimal pattern to increase the extinction ratio is the line width of 45nm and more than 1:2 aspect ratios. Nanoimprint process is a method to transfer pattern using the mold which carved fine pattern, it is a technique that can be replicated repeatability at a low cost and simple. So, using the nanoimprint technology, it is possible to make the pattern size to 45nm or less. In this study, we check the Fe_3O_4 that is suitable material as an absorptive layer through the simulation. Especially, when the thickness of Fe_3O_4 is 70nm, it was confirmed the optimal conditions which transmittance 40% or more, reflectance 5% or less, the extinction ratio more than 5000:1. So, we deposited the Fe_3O_4 about 100nm on the glass wafer using an E-beam evaporator. Also, we made the 45nm line/space pattern using nanoimprint process and we could be reduced the residual layer up to about 20nm thickness. We will suggest several possible etching gases and optimal condition with proper etch selectivity

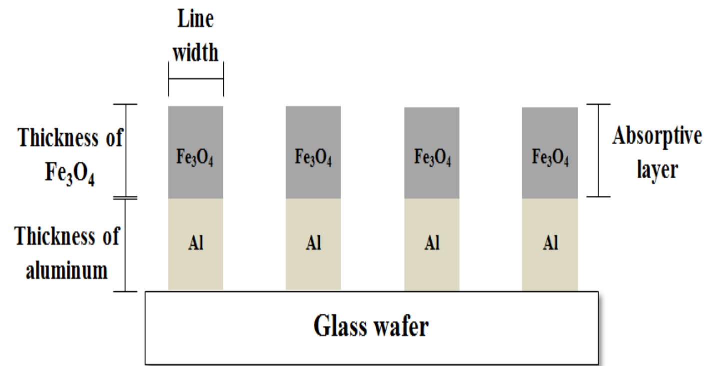

Figure 1. Proposed model of absorptive WGP

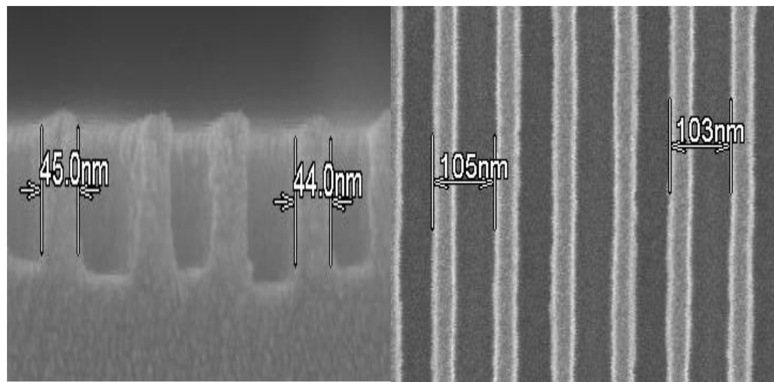

Figure 2. 45nm Line/space pattern by nanoimprint

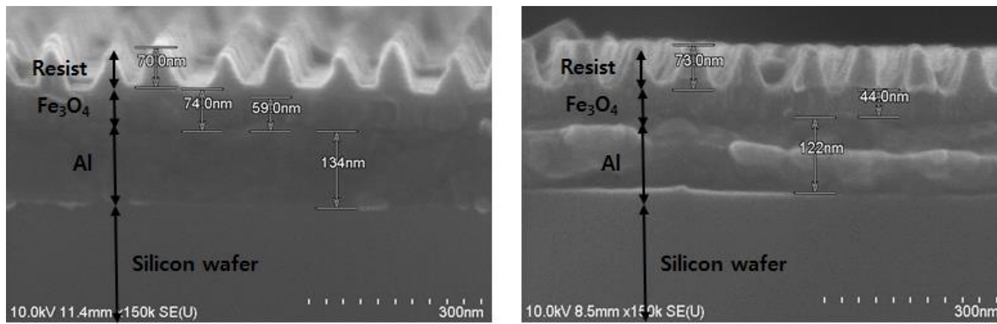

Figure 3. Etched Magnetite by HBr gas