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Femtosecond laser ultra-precision hybrid machining

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1. INTRODUCTION

One of display trends today is development of high pixel density. To get high PPI, a small size of pixel must be developed. RGB pixel is arranged by evaporation process which determines pixel size. Normally, a fine metal mask (FMM; Invar alloy) has been used for evaporation process and it has advantages such as good strength, and low thermal expansion coefficient at low temperature(1). A FMM has been manufactured by chemical etching which has limitation to controlling the pattern shape and size. Fig. 1 shows FMM chemical etching process. One of alternative method for patterning FMM is laser micromachining. Femtosecond laser is normally considered to improve those disadvantages for laser micromachining process due to such short pulse duration(2,3). In this paper, a femtosecond laser drilling for thickness of 30 ㎛ FMM is examined. Additionally, we introduce experimental results for controlling taper angle of hole by vibration module adapted in laser system.

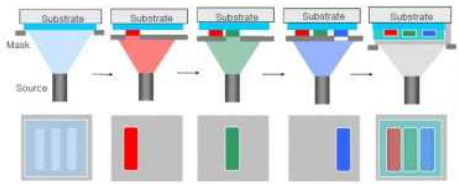

Fig. 1 RGB evaporation process of AMOLED production

2. EXPERIMENTAL SETUP

We used Ti:Sapphire based femtosecond laser with attenuating optics, co-axial illumination, vision system, 3-axis linear stage and vibration module.

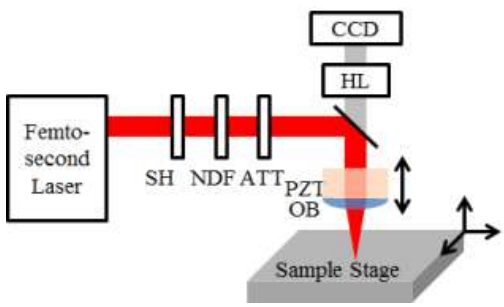

Fig. 2 Schematic of vibration assisted femtosecond laser machining system

3. EXPERIMENTAL RESULT

Fig. 3 shows vibration assisted femtosecond laser hole drilling result. By controlling vibration amplitude, entrance and exit diameters are controllable.

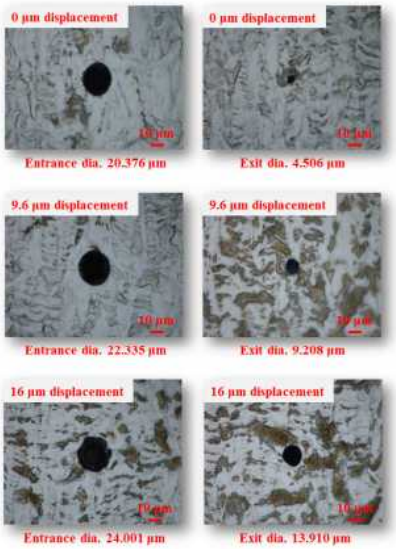

Fig. 3 Experimental result of vibration assisted femtosecond laser hole drilling

Using vibrating objective lens, we can control taper angle when femtosecond laser hole drilling by moving focusing point. The larger amplitude of vibration we control, the smaller taper angle will be carried out.

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