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Low temperature excimer laser annealing of *a*-InGaZnO thin-film transistors passivated by hybrid organic-inorganic passivation layer

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Amorphous InGaZnO (*a*-IGZO) have been widely used as channel material for thin-film transistors (TFTs) because of its good electrical properties [1]. Its wide band gap and low temperature fabrication is indispensable for advanced applications in transparent and flexible devices. Nevertheless, annealing up to 400°C is required to improve the performance and stability [1]. Conventional annealing methods do not selectively anneal the channel but also heats up other layers. This limits the substrate materials that can be used for flexible applications. Excimer laser annealing (ELA) has been proposed as a solution because it can selectively anneal the channel and ensure low local heating at the substrate layer [2]. Because it is able to selectively anneal, ELA can be used in more advanced applications such as in self-aligned structures [2]. However, previous studies employed ELA on unpassivated TFTs [2].

It is well known that passivation layers are required to improve the stability of *a*-IGZO TFTs [1]. We have previously reported hybrid organic-inorganic passivation layers based on polysilsesquioxane (PSQ) [3]. The PSQ passivation is easily fabricated by solution process and greatly improves the reliability of *a*-IGZO.

In this work, we report the use of ELA as a low temperature annealing method of *a*-IGZO passivated with PSQ. We used either XeCl ELA (308 nm) or KrF ELA (248 nm). Figures 1 and 2 clearly shows that ELA improved the characteristics of passivated TFTs. ELA samples had high mobility (13-18 cm^2/Vs) and high on/off ratio. Furthermore, we have confirmed by COMSOL simulation that the substrate temperature during ELA is quite low at less than 300K. These results show the potential of ELA as an alternative low temperature annealing method.

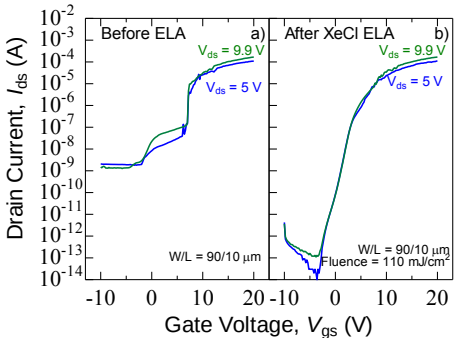

Fig. 1. Transfer characteristics a) before ELA and b) after XeCl ELA of methylsilsesquioxane PSQ (Me 100) passivated TFTs

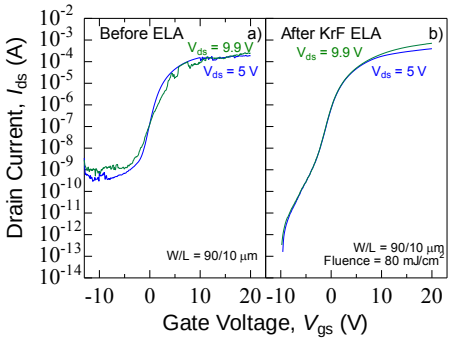

Fig. 2. Transfer characteristics a) before ELA and b) after KrF ELA of methylsilsesquioxane-phenylsilsesquioxane PSQ (Me 60/Ph 40) passivated TFTs

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