150 nm T-shape Gate Process Capacity Improvement

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A production ready 150nm T-shape gate pseudomorphic high electron mobility transistor (pHEMT) using electron beam lithography process has been developed.
Except for its historical lower throughput of electronic beam writer, process yield also effects fabricated capacity of product in a Fabrication. However, to reach sub-150 nm structures, a variety of extra process steps before, during or after e-beam irradiation should be implemented. Develop step plays an important role in the success of e-beam patterning and this can be seen in the impress number of papers.

Thin Poly(methylmethacrylate) (PMMA)/copolymer (MMA (8.5) MAA) films were spin-coated onto GaAs substrate. The molecular weight of PMMA used was 950 Kamu and the thickness was 160–180nm. Usually, dual layers resist of Poly(methylmethacrylate) (PMMA)/copolymer (MMA (8.5) MAA) are applied to patterning 150 nm gate profile and they are sensitive to developer with solvent base of Methyl Isobutyl Ketone (MIBK). A typical 150 nm develop method is manual stirring in thermal beakers by technicians as shown in Figure1, it easily have the CD (critical dimension) stability issue without consistency from different operators as shown in Figure3 & 4. Model as shown in Figure2 that an automatic TRK developing system instead of manual operating by technicians will be implemented to gate forming step to get good develop CD uniformity as shown in Figure4. It reduces the CD variation with 3 sigma$\leqq$5.2nm and get better of profile as shown in Figure6, LER(Line edge roughness).

And it also benefit to the throughput of this develop step with one stop instead of multiple manual operating.

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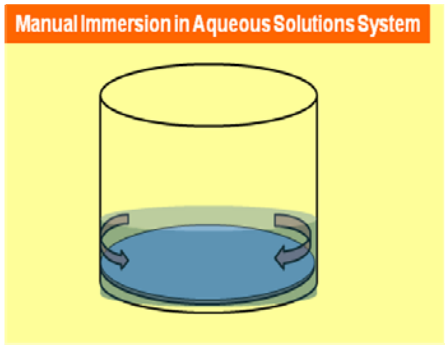

Figure1 Manual immersion in Aqueous solutions system

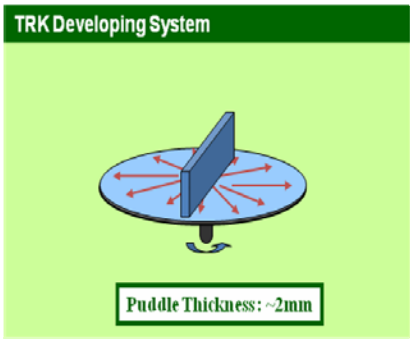

Figure2 TRK developing system

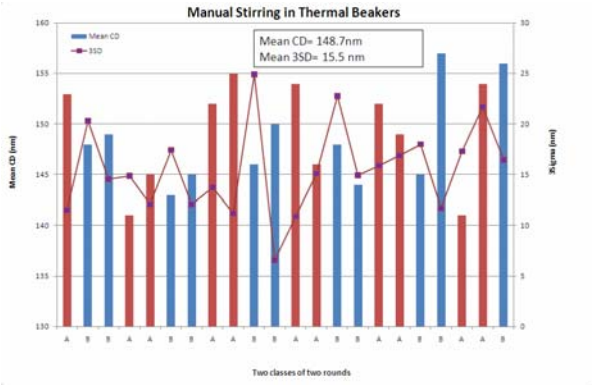

Figure3 Manual immersion in Aqueous solutions system Monitoring Data

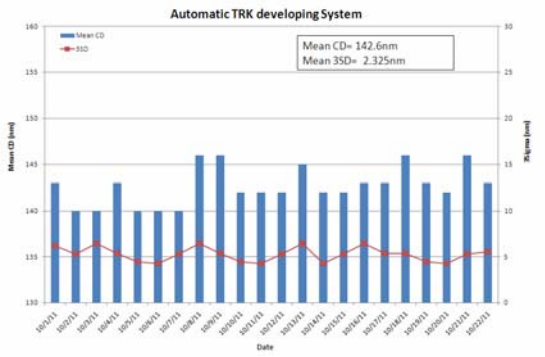

Figure4 TRK developing system Monitoring Data

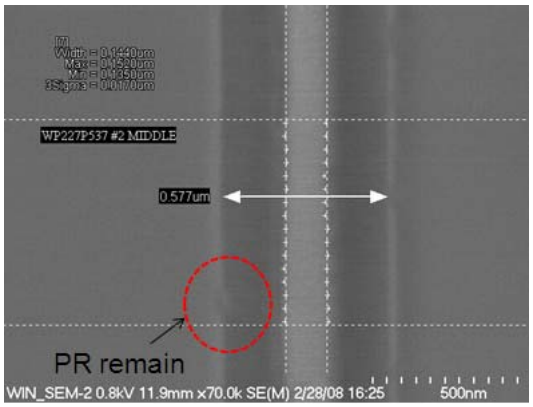

Figure5 Manual immersion in Aqueous solutions system defect

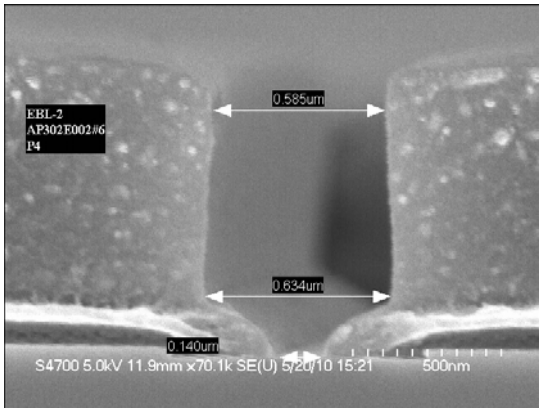

Figure6 TRK developing system of PR profile