7×6 INCH MULTI WAFER PLANETARY REACTOR®
AS USED FOR P-HEMT AND HBT APPLICATIONS

Jochen Hofeldt, Thomas Schmitt, Martin Dauelsberg, Michael Volk, Michael Heuken, Holger Jürgensen

AIXTRON AG, Kackertstr. 15 - 17, D-52072 Aachen, Germany
Tel: +49 (241) 89 09 - 0, Fax: +49 (241) 89 09 - 149; e-mail: heu@aixtron.com

The AIXTRON Planetary Reactors® are proven to grow extremely uniform films together with a highly efficient utilization of the precursors. The novel reactor in 7x6" configuration is based on the proven AIXTRON Planetary Reactor®, which, in its 5×4" configuration, is already qualified for the production of InP-based HBTs for 40 GBit/s backbone data transmission amplifiers.

We investigated the growth and doping of (Al)GaAs and GaInP which are prominent materials in GaAs-based HEMT and HBT. Tab. 1 shows adjusted doping levels in the 7×6 inch configuration established by Hall-effect measurements and homogeneities measured in a Lehighton sheet resistance mapper in GaAs and AlGaAs layers. Wafer-to-wafer homogeneities were found to be in the range of ±0.4% for n-type and ±0.7% for p-type GaAs.

Tab. 1: On-wafer homogeneities of doping concentration for selected material systems (see also figs. 1-3)

Material	doping level [cm^{-3}]	standard deviation
GaAs	$n=8\times10^{17}$	1.24%
	$p=3\times10^{19}$	1.1%
$Al_{0.3}GaAs$	$n=1\times10^{17}$	1.26%
GaInP	$n=1\times10^{18}$	3%

GaInP layers grown in this configuration exhibited a standard deviation of the Ga concentration of 0.75% resulting in a wavelength standard deviation of 2 nm. The thickness homogeneity on-wafer was 0.5%. $Al_{0.3}GaAs$ layers exhibited a standard deviation of 0.5% in the Al-composition and a thickness standard deviation of 0.17% for layers of ~2 µm thickness.

Unique uniform temperature distribution on-wafer as well as from wafer-to-wafer of better than ±1° C determined by pyrometric temperature measurement will be shown. In addition we will present modeling results (Fig. 4) and additional experimental data on wafer-to-wafer and on-wafer thickness homogeneities and compositions of AlGaAs, GaInP and GaAs which prove the qualification of the 7×6 inch configuration for the large scale production of p-HEMTs and HBTs.

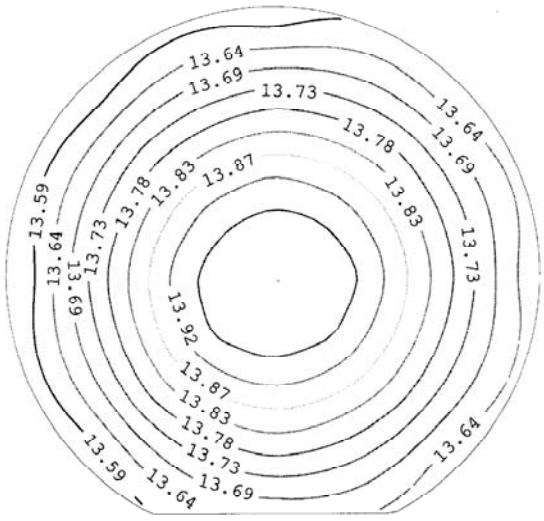

Fig. 1: Sheet resistance mapping of n-type doped GaAs grown in the 7x6 inch configuration.

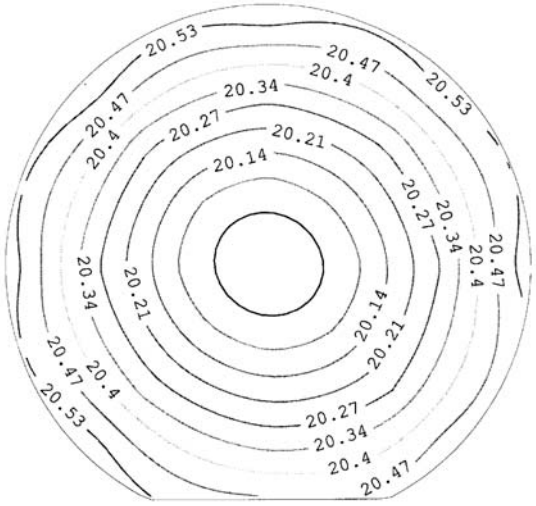

Fig. 2: Sheet resistance mapping of p-type doped GaAs grown in the 7x6 inch configuration.

Fig. 3: Sheet resistance mapping of n-type doped $Al_{0.3}GaAs$ grown in the 7x6 inch configuration.

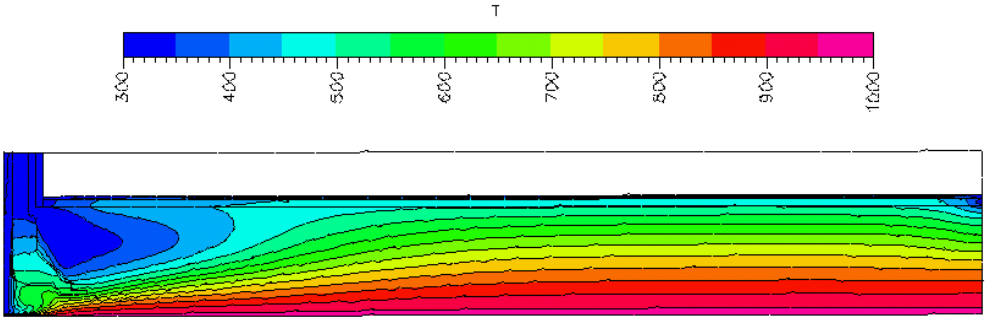

Fig. 4: Temperature distribution in the AIX 2600 G3 (7x6") reactor process chamber