Development of High-Speed CVD Process on SiC Homoepitaxial Growth

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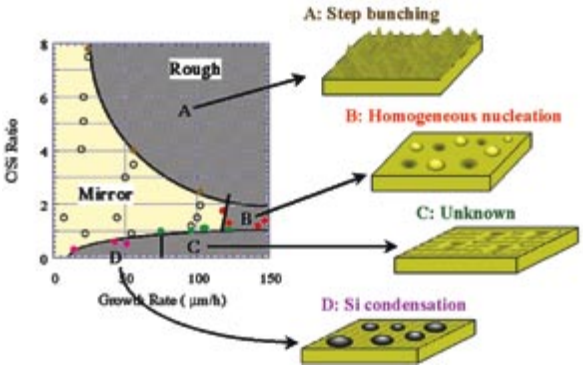
AIST Today Vol. 4, No.6 (2004) 15

We have carried out the epitaxial growth of 4H-SiC by CVD method with the various growth conditions. We found that the C/Si ratio influences strongly on the surface morphology of epilayers, and that the window of the C/Si ratio bringing about mirror-like surfaces becomes narrow with the increase of growth rate. We also found that the change from mirror to rough with the growth conditions is abrupt, and that it is important to introduce the process gases in the early growth stage. Based on these results, we have achieved two orders in magnitude higher than usual growth rates.



The relationship between the C/Si ratio and the growth rate

Development of Alternative Cleaning Agent

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AIST Today Vol. 4, No.6 (2004) 19

The development of environmental friendly alternatives to prevent the depletion of the ozone layer and global warming is necessary for a sustainable society. In this research, 6 HFEs (Hydrofluoroethers) have been developed as new alternative cleaning agents. These HFEs were selected out of 88 compounds by various evaluations such as physical properties, toxicity and atmospheric life time. Also, we developed an efficient synthetic process of HFEs using water as a solvent in the addition reaction of alcohol to fluorinated olefin.

HFE-347pc-f ($CHF_2CF_2OCH_2CF_3$) has been already commercialized, and its use will be extended further.

Evaluation of 12 fluorinated ethers for alternative cleaning agent

#	Structure RITE name	Bp (℃)	Properties	Flammability	Stability	Toxicities	Life time (year)	Selection
1	$CF_3CF_2CH_2OCHF_2$ HFE-347pc-f	45.9	○	○	○	○	5.7	○
2	$CF_2CHFCF_2OCH_3$ HFE-356pcf3	54.3	○	○	○	○	2.1	○
3	$CHF_2CF_2OCH_2CF_3$ HFE-347pc-f	56.2	○	○	○	○	6.0	○
4	$CF_3CH_2OCF_2CHF_2$ HFE-356mf2-s	65.0	○	○	○	○	-	-
5	$(CF_3)_2CHCF_2OCH_3$ HFE-458mmz	69.9	○	○	×	×	-	×
6	$CF_3CF_2CH_2OCF_2CHF_2$ HFE-449pc-f2	70.3	○	○	○	△	-	×
7	$CF_3CHFCF_2OCH_2CF_3$ HFE-449pc-f	72.7	○	○	○	○	7.0	○
8	$CHF_2CF_2CH_2OCHF_2$ HFE-356pcf	76.5	○	○	×	×	4.0	×
9	$CF_3CHFCF_2OCH_2CF_2CF_3$ HFE-54-11mec-f	87.5	○	○	○	○	6.7	○
10	$CF_3CHFCF_2CH_2OCHF_2$ HFE-458pcf	88.4	○	○	○	○	-	-
11	$CHF_2CF_2CH_2OCF_2CHF_2$ HFE-458pc-s	93.2	○	○	○	×	-	×
12	$CF_3CHFCF_2OCH_2CF_2OHF_2$ HFE-55-10mec-fc	105.9	○	○	○	○	4.8	○