반응성 CVD를 이용한 다결정 실리콘 기판에서의 $CoSi_2$ layer의 성장거동과 열적 안정성에 관한 연구
(Growth behavior and thermal stability of $CoSi_2$ layer on poly-Si substrate using reactive chemical vapor deposition)

한국과학기술원 재료공학과 김선일, 안병태

Uniform polycrystalline $CoSi_2$ layers have been grown *in situ* on a polycrystalline Si substrate at temperature ranging from 600℃ to 650℃ by reaction chemical vapor deposition of cyclopentadienyl dicarbonyl cobalt, $(C_5H_5)Co(CO)_2$. The growth behavior and thermal stability of $CoSi_2$ layer on polycrystalline Si substrates were investigated. A TiN interlayer was introduced between $CoSi_2$ layer and polycrystalline Si substrates to improve the thermal stability of the $CoSi_2$ layer.

X-ray diffraction and transmission electron diffraction analysis showed that the plate-like $CoSi_2$ spikes were initially formed in coherent with either {111}, {220} or {311} interface of polycrystalline Si grain. A uniform epitaxial $CoSi_2$ layer was grown from the discrete $CoSi_2$ plate, where the orientation of the $CoSi_2$ layer is same as the orientation of polycrystalline Si grain. But the interface between $CoSi_2$ layer and polycrystalline Si substrate was always {111} coherent. The thickness of the uniform $CoSi_2$ layer had a parabolic relationship with the deposition time.

The growth behavior of $CoSi_2$ layer on amorphous Si substrate was also investigated. In initial deposition stage, $CoSi_2$ was nucleated at random sites and grown in spherical shapes. The $CoSi_2$ layer on amorphous Si substrate has smaller grains size and larger interface roughness than that on polycrystalline Si substrate.

The thermal stability of $CoSi_2$ layer on small grain-sized polycrystalline Si has been investigated using sheet resistance measurement at temperature from 800℃ to 1000℃. The amorphous Si and TiN layer were used to improve the thermal stability of $CoSi_2$ layer. When the $CoSi_2$ layer was prepared from the reactive chemical vapor deposition on amorphous Si, the $CoSi_2$/poly-Si gate electrode has poor thermal stability. When a TiN layer of 35nm thickness was introduced between these two layers, the sheet resistance of $CoSi_2$/TiN/poly-Si was not significantly changed even at 1000℃, indicating that the TiN interlayer improved thermal stability of $CoSi_2$ layer on polycrystalline Si substrate. The stability improvement is due to minimizing the diffusion of Co by the TiN layer.