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ЕРЕВАНСКИЙ ФИЗИЧЕСКИЙ ИНСТИТУТ

ЕФИ-479(22)-81

G.N.ERITSYAN, R.A.MELKONYAN, Yu.R.NAZARYAN,
A.S.OGANESSYAN, A.A.SAHAKYAN, D.T.TARASHCHENKO

REFLECTION SPECTRA OF SILICON CARBIDE IN VACUUM ULTRAVIOLET REGION

ԵՐԵՎԱՆ 1981 ЕРЕВАН

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Г.Н.ЕРИЦЯН, Р.А.МЕЛКОНЯН, Ю.Р.НАЗАРЯН,
А.А.СААКЯН, А.С.ОГАНЕСЯН, Д.Т.ТАРАЩЕНКО

СПЕКТРЫ ОТРАЖЕНИЯ КАРБИДА КРЕМНИЯ В ОБЛАСТИ ВАКУУМНОГО УЛЬТРАФИОЛЕТА

Изучены спектры отражения монокристаллического карбида кремния 6H и I5R политипов в спектральной области 6,0–9,0 эВ используя в качестве источника синхротронное излучение. Полученные спектры мало отличаются в случае 6H от оптического спектра. Характерный максимум отражения находится при 7,8 эВ , однако отражательная способность I5R в длинноволновой части спектра в области вакуумного ультрафиолета заметно больше,чем у кристаллов 6H. Результаты сравниваются с измерениями квантового выхода.

Ереванский физический институт
Ереван I98I

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The reflection spectra of silicon carbide monocrystals of 6H and 15R polytypes are measured in spectral 6.0 - 9.0 region using the synchrotror radiation as a source. The spectra obtained do not differ much from the optical spectrum of polytype 6H. A characteristic reflection maximum can be found at 7.8 eV, however the reflectance of monocrystals 15R in the longwave part of the spectrum is noticeably higher than that in 6H. The results are compared with the quantum yield measurements.

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G.N.ERITSYAN, R.A.MELKONYAN, Yu.R.NAZARYAN,
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The reflection spectra of silicon carbide monocrystals of 6H and 15R polytypes are obtained in spectral 6.0 - 9.0 region using the synchrotron radiation of the Yerevan 5 GeV electron accelerator as the source of light. The measurements were done in the synchrotron channel by means of a vacuum monochromator assembled by the optical Seia-Namioka scheme with the diffraction grating 1200 groves per mm and the radius of curvature 1 m [1].

Due to the current instability in the accelerator the synchrotron radiation intensity noticeably oscillates, which fact is responsible for some definite complications in the optical measurements process. In this connection we have built up a device permitting to separate the SR beam behind the exit monochromator slit into two ones, one of which served at measurements as the basic one [2].

Both basic and reflected beams from the specimen were detected by a photomultiplier with the sodium salicylate luminophor. The measurement results of reflection spectra of α-SiC(6H) are presented in Fig.1 (curve R).

Earlier, with the aim to obtain the information on a zone structure we carried out photoemission investigations of hexagonal silicon carbide [3]. These investigations included the measurement of spectra characteristics of a quantum yield of photoelectron emission and energy spectra of emitted pho-

toelectrons in a wide spectrum interval embracing the vacuum ultraviolet region (up to 11.6 eV). A part of a spectrum characteristic of photoemission quantum yield in 6 - 10 eV region is given in Fig.1 (curve SiC). Ibidem a spectrum characteristic of a metal emitter (curve M) that served as a secondary standard at measurements is presented.

Comparing the energy position of singularities on a spectrum curve of a quantum yield (a part of this curve near the threshold is built here in an enlarged scale Y x 10) with that in optical spectrum α - SiC(6H), one can see that their energies do not differ much, though they have different character of display. Although the highest reflection peak at $h\nu \sim 7.8$ eV is most characteristic for the optical spectrum α - SiC(6H), this singularity can be hardly noticed on the curve of the photoemission quantum yield. The singularity on the spectrum curve of a quantum yield at $h\nu \approx 9.4$-9.8 eV is pronounced rather distinctly, and the peak at $h\nu \approx 9.6$ eV apparently corresponds to it in the reflection spectrum obtained in Weeler's work [4] (curve R_W). It should be noted that both spectrum characteristics of the photoemission quantum yield and the Weeler optical spectrum are obtained without syncrotron radiation.

Using the synchrotron radiation we have obtained for the first time the reflection spectrum of rhombohedrical monocrystals α - SiC(15R) (Fig.2). As is seen from Fig.2, the spectra of these crystals do not differ much from the optical spectrum of polytype 6H obtained under similar conditions. A characteristic reflection maximum, as it was in polytype 6H, can be found at 7.8 eV; however the reflectance of monocrystals 15R in the longwave part of the spectrum is noticeably higher than that in 6H.

These results were reported at the Joint Soviet-English Seminar on Synchrotron Radiation Use (Moscow, September, 1979) and also at 17-th International Conference on Solid State Physics (England, Warwick, January, 1930).

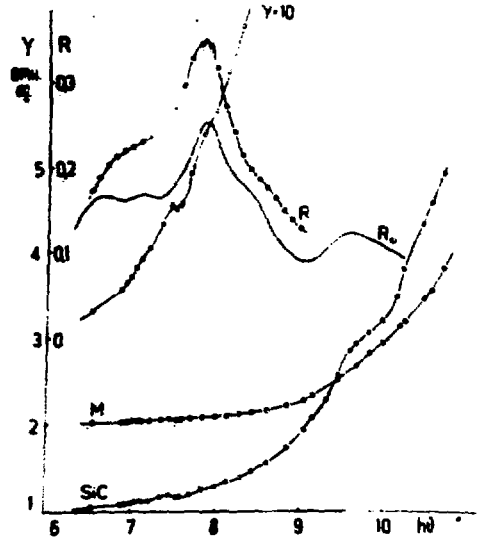

Fig.1 Reflectance and quantum yield spectra of hexagonal single crystals α - SiC(6H).

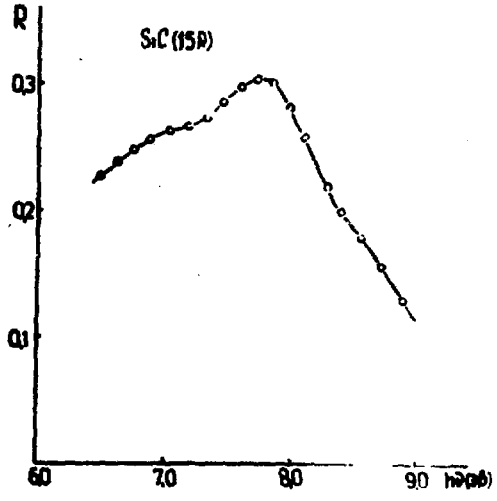

Fig.2 Reflectance spectrum of rhombohedrical α -SiC(15R).

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