Anisotropy of c-facet of hcp solid ^{4}He

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Recently we have observed the so-called devil's staircase of high order facets on the surface of hcp ^{4}He crystals at 0.2 K. Such high roughening temeratures of high order facets belonging to family [10-1N] suggest that there must be an anomaly in the stiffness of vicinal surfaces and of the step on basal c-facet at correspoding orientation which was never observed before. With our interferometric technique we were able to measure the stiffness of the step on [0001] c-facet and the azimuthal stiffness of vicinal surfaces at small polar angles ($2^\circ - 10^\circ$). Below 0.2 K we have found a strong aniotropy of the stiffnesses, as high as 5-10. The anisotropy rapidly decreases as temperature increases and seems to saturate at low temperatures.

We have adopted the standard theory of renormalizations by thermal fluctuations of the surface by assuming the anisotropy in the bare, unrenormalized surface stiffness. The theory gives a good explanation of the thermal dependence of the step energy on the c-facet and of the anisotropy, while the model of free kinks on the step predictes exponentially fast increase of both the energy and the anisotropy at low temperatures.

The measured azimuthal surface stiffness at low temperatures has the value of 1 erg/cm^2 in maximum which suggests that high order facets with N up to 10 should be present at temperatures below 0.2 K.