

The Modulated Structures of Rutile in High Pressure Metamorphic Rocks

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Rutile is the most popular among all the variants of TiO_2 . Its molecular volume is the smallest, so it tends to be formed under high pressure and high temperature and always appears as a fine-grained accessory mineral in high-pressure metamorphic rocks. Symmetry: tetragonal system; space group: $P4_2/mnm$; cell parameters: $a=0.458\text{nm}$, $c=0.295\text{nm}$. The ultra-structure characteristics of rutile in high-pressure metamorphic rocks in Dabie Mountains, China, have been investigated by SAED and HRTEM. The Two-dimensional commensurate modulated structures have been discovered and confirmed. The corresponding analyses are as following:

The SAED patterns with $[100]$ orientation prove the presence of the modulated structures in rutile. The long period along $\langle 011 \rangle$ modulation direction is integer times of the fundamental period, i.e. the distance between the satellite spot and the base spot is triple of the cell parameter in rutile. The modulation wave vectors are $q_1=0.33(b^*+c^*)$ and $q_2=0.33(-b^*+c^*)$, representing commensurate modulated structures along two $\langle 011 \rangle$ directions with repetition 0.747nm ($d_{011} \times 3$). The HREM images with $[100]$ orientation shows the modulation period formed by three base unit layers along $[011]$ and $[0\bar{1}1]$ modulation direction. The dislocations of the cations or the changes of the positional ordering in rutile are probably the main factor to form the modulated structures.

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