2008년 9월 10일 수요일
오후 5:17

$$\vec{a_p} = \frac{a}{2}(-\hat{x}+\hat{y}+\hat{z})$$
$$\vec{b_p} = \frac{a}{2}(\hat{x}-\hat{y}+\hat{z})$$
$$\vec{c_p} = \frac{a}{2}(\hat{x}+\hat{y}-\hat{z})$$

$$\vec{b_p}\times\vec{c_p} = \frac{a^2}{4}(\hat{x}-\hat{y}+\hat{z})\times(\hat{x}+\hat{y}-\hat{z})$$
$$= \frac{a^2}{4}(\hat{z}+\hat{y}+\hat{z}+\hat{x}+\hat{y}-\hat{x})$$
$$= \frac{a^2}{2}(\hat{y}+\hat{z})$$

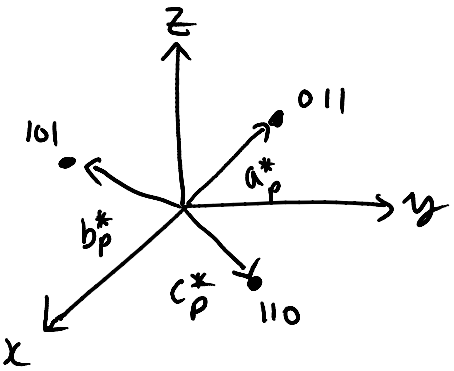
$$\vec{a_p}\cdot(\vec{b_p}\times\vec{c_p}) = \frac{a^3}{4}\cdot 2 = \frac{a^3}{2}$$

now, $\vec{a_p^*} = \dfrac{\vec{b_p}\times\vec{c_p}}{\vec{a_p}\cdot(\vec{b_p}\times\vec{c_p})} = \dfrac{1}{a}(\hat{y}+\hat{z})$

in the same manner,

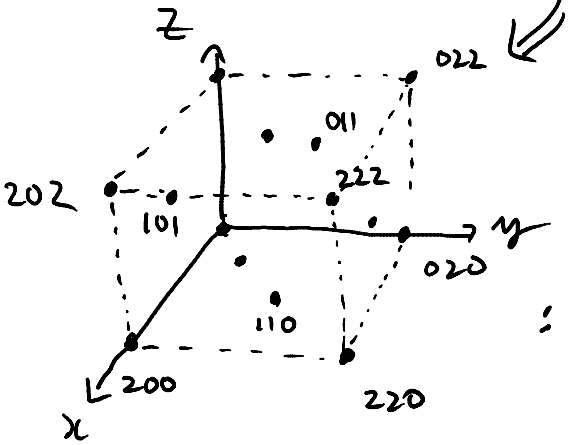
$$\vec{b_p^*} = \frac{1}{a}(\hat{z}+\hat{x}) \quad , \quad \vec{c_p^*} = \frac{1}{a}(\hat{x}+\hat{y})$$

from these reciprocal primitive vectors, we can construct a reciprocal lattice space.



$\Rightarrow$ $a_p^* + c_p^* - b_p^*$: 020
$a_p^* + b_p^* - c_p^*$: 002
$b_p^* + c_p^* - a_p^*$: 200

020+002 : 022
020+200 : 220
002+200 : 202
020+002+200 : 222
⋮



: you can figure that this reciprocal lattice we have obtained is

a FCC lattice

Notes.

- since finding a reciprocal lattice involves the operation of unit lattice vectors, if you don't have unit lattice vectors from a primitive cell you won't be able to take the full information of the lattice into account.
- Since both the real lattice and reciprocal lattice has been expressed with a common set of vectors $(\hat{x}, \hat{y}, \hat{z})$, we can easily see the relative orientation of the two lattices. For example, the (111) plane in real space is orthognal to the [111] direction in reciprocal space.
- you can notice here again how the planes in real space correspond to the lattice points in reciprocal space.