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An unusual phase composition in the RbF-bearing synthetic fluid inclusions

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The synthetic fluid inclusions (SFI) were synthesized by the cracks-healing method at T=350°C and P=1kbar from 1M RbF solution.

Two liquid, crystalline and vapor phases are coexist in these SFI at room temperature. It is a very unusual fact: phase boundary between two inorganic liquids is usually detected when one phase (liquid) is in super-cooled (glass-like) state. For example: silicate glass plus fluid bubble in the natural melt inclusions. The evidence of liquid immiscibility at high temperature (above the boiling point) is typically for some water-salt systems. In this case, the phase boundary is appeared (in form of meniscus) between two liquid phases in the field of immiscibility. It was expected the existing one of two liquids in super-cooled state in these SFI. However it was found that both liquids were freezed during cryometric investigations. More dense liquid (L2) was freeze at -40°C. A stepwise temperature increasing was leaded to eutectic melting at -38°C and ice melting process was terminated at -1.8°C. The eutectic temperature for H_2O–RbF system is unknown. If we suppose the liquid L2 is the RbF solution then eutectic temperature is similar to -38°C. However, the high probability of generation and catching the intermediate composition phase into this L2 liquid. This intermediate composition phase may be produced by the chemical interaction of silicate substances with water-salt fluid under run condition. If we have terminated freezing at -55°C, then less dense phase (L1) did not freezing and was existed in liquid state between -55 to -1°C. This L1 phase began crystallize at temperature -1°C with dendritic crystals appearing. Apparently the metastable behavior during super-cooled liquid crystallization was demonstrated by this way.

It is not clear why the solid phases appearing have begins at temperature increasing only. The separate parts of these dendritic crystals begin melt during temperature increasing up to -0.5°C. This melting process produces the appearing of L1 liquid globules which are located in the L2 liquid. These globules do not aggregate to each other during a long period (a few months approximately). The crystals of the L1 liquid melt are similar to pure substance: the true phase transition from solid state to liquid is carried out. There are no small vapor bubbles or ice crystals during this Solid → Liquid transition as it usually take place during water solution melting. The difference is only one: the melting interval is relatively wide – a full transformation to liquid is originated at +10°C only.

To freeze the L1 liquid is possible during cooling to -90°C. The shagreen surface and small vapor bubbles are detected clearly in separate L1 liquid globules. Therefore, both liquid phases (L1 and L2) are not the super-cooled glass-like materials because melt points of these liquids are existed at lower temperatures. In other words, the immiscibility phenomena are existed at +20-25°C between water-salt solutions which content the same salts.

Fluid inclusions heating up to more high temperature do not produce a new phase transitions. The meniscus between two liquid phases (L1 and L2) at +75-92°C becomes invisible (in consequence of the similar refractive coefficients of both L1 and L2 liquids); and at more high temperatures this meniscus appear again at the same place.

Fluid inclusions are decrepitated at 250°C.