Ruby Formation Using Plasma

Hyogo Prefectural Kobe High School sougourigaku course　Hiroto Odaka　Ryogo Kitagawa　Ryousuke Nakajima　Yu Nishiura　Yuma Muto

Purpose

In artificial ruby formation, Verneuil method is mainly used. This way can form a big ruby crystal, but it requires huge facilities. So our goal is to establish a new way to form ruby crystals by using a microwave oven, which everyone has in their house.

Aim for the preparatory experiment

To examine whether ruby can be fundamentally formed by using a 1000W microwave oven, turning on ruby formation using plasma.

Method for the preparatory experiment

① Wrap mixture of alumina and chromium oxide with aluminum foil like figure 1.

② Search for a position micro waves concentrate in on a microwave oven, find the point where sparks occur from the top of the aluminum foil, and continue sparks.

③ After sparks go out, let the sample cool off, and observe whether ruby has formed at the top of the aluminum foil.

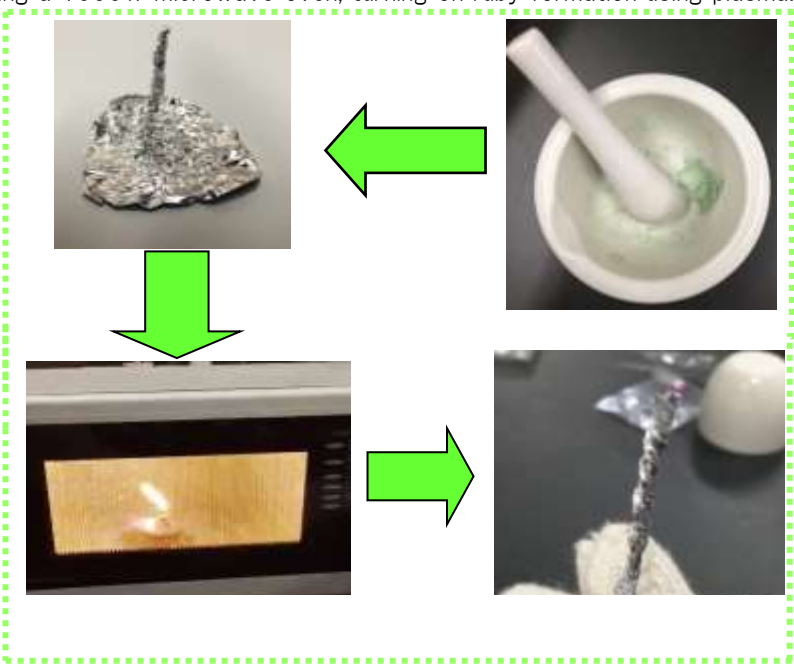


Figure 1

Result of the preparatory experiment

We conducted the experiment 3 times, and succeeded in all 3 times. Accordingly, it is possible to form ruby by using a 1000W microwave oven.

Method for the main experiment

① Set 10.0g silica gel, and fix a mechanical pencil lead to it vertically.

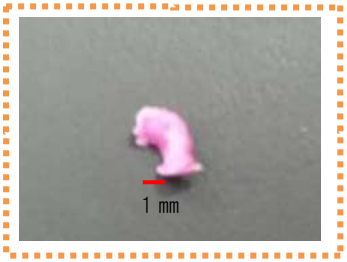
② Set the top of the lead at a position micro waves concentrate in on, cover it with a beaker, and retain plasma.

③ Using the plasma's heat, melt mixture of 1.00g alumina and 0.01g chromium oxide. Then let it cool off, and form ruby.

Result for the main experiment

Though we could form plasma at the top of the lead, we couldn't retain the state. But, we confirmed sparks were flying from both sides of the lead. We thought that the sparks could melt the mixture. So we exchanged silica gel for the mixture. Then part of the mixture melted by sparks which were caused from the bottom tip of the lead, and 0.01g ruby (the right figure) was formed. Therefore we thought this experiment method is better than the preparatory experiment method because we could get a bigger ruby.

Figure 2



Consideration

It was difficult to retain plasma, whose heat is used to melt mixture of alumina and chromium oxide. It can be considered that the reason was we didn't have enough equipment to conduct the experiment a professor at Nagoya University had done . With the new method we were able to form a bigger ruby than that of the preparatory experiment. It was because sparks hit on larger ambit of the mixture. The new method is better than preparatory one, considering the size of formed ruby. But in quality and quantitatively, the new one is inferior to Verneuil method. We couldn't judge whether plasma is fit for ruby formation because the number of experiments is few. If given the chance, we'll investigate this experiment more and discover new method to form ruby.

(References：・http://wwwfs.acs.i.kyoto-u.ac.jp/~syuji/20081122/fireball.pdf・魅了する科学実験／総合出版すばる舎)