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Synthesis and characterization of brannerite UTi_2O_6

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The share of nuclear energy in order to supply electricity continues to increase, which makes a growing need for more uranium resources. Currently uraninite (UO_2) and coffinite ($USiO_4$) are the two most abundant and exploited minerals. With the exhausting of these resources, other minerals are currently considered and are subject to multiple studies. Among them brannerite (UTi_2O_6) represents the third source of tetravalent uranium on Earth and could be considered for uranium recovery.¹ However, brannerite is known to be very difficult to dissolve quantitatively even in very aggressive conditions.² Consequently, the multiparametric study of dissolution of this phase has to be studied in details.

In this work, we first focused on the synthesis of pure brannerite by developing new methods of synthesis free from heavy grinding steps in contrary of the alkoxide/nitrate based routes.³ The impact of several parameters were studied such as heating temperature of synthesis, holding time and atmosphere. Therefore a new method was developed based on the preparation of hydroxides mixture then it direct heating under Ar or N_2 atmosphere for 72 hours at $1300^\circ C$.

Finally, dissolution experiments were carried out under different conditions in order to provide multiparametric expression of the normalized dissolution rate.

References

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