

Complex patterned precipitation dynamics in toroidal reactors with two diffusion sources

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Abstract: A toroidal reactor of 1.00 cm cross-sectional diameter, 6.50 cm inner diameter and 8.5 cm outer diameter is filled with $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$ (0.10-0.20 M) and 1% agar gel solution. Two outer electrolytes, of suitably chosen concentrations, are employed to diffuse into the gelled solution: from one end NH_4OH to precipitate $\text{Co}(\text{OH})_2$, and from the other end Na_3PO_4 to precipitate $\text{Co}_3(\text{PO}_4)_2$. The resulting diffusion-precipitation (Liesegang) pattern exhibits unusual trends wherein abnormal gaps, front wave stopping and formation of cobalt phosphate polymorphs are observed. The self-organized structure reveals a complex underlying dynamical scenario. Using the well-known generic empirical laws, we attempt the computation of the band locations and represent them graphically within the torus.

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