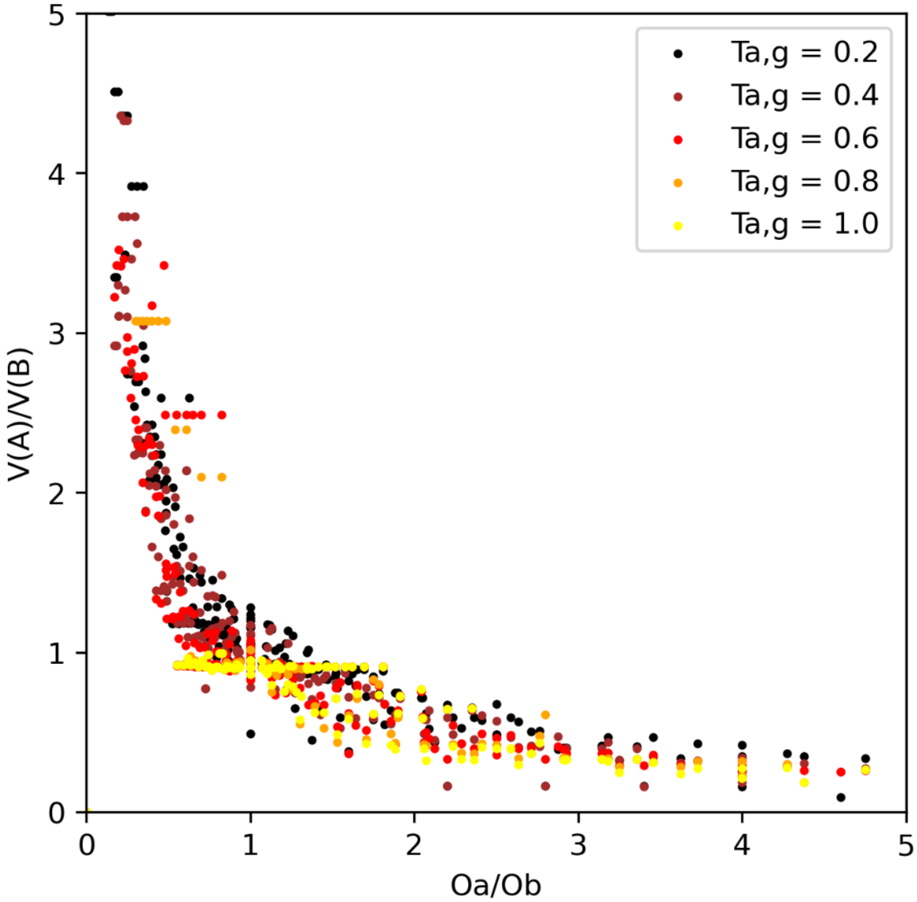

Figure S1. Influence of the relative intensity of *Oa* and *Ob* on the relative volumes of phases *A* and *B* (*V(A)* and *V(B)*) precipitated. If the chemical oscillation due to *A* precipitation is higher than the chemical oscillation due to *B* precipitation, the volume of *B* precipitated is larger than the volume of *A* precipitated. *Tb,g* equal to 0.2 for all simulations shown here.

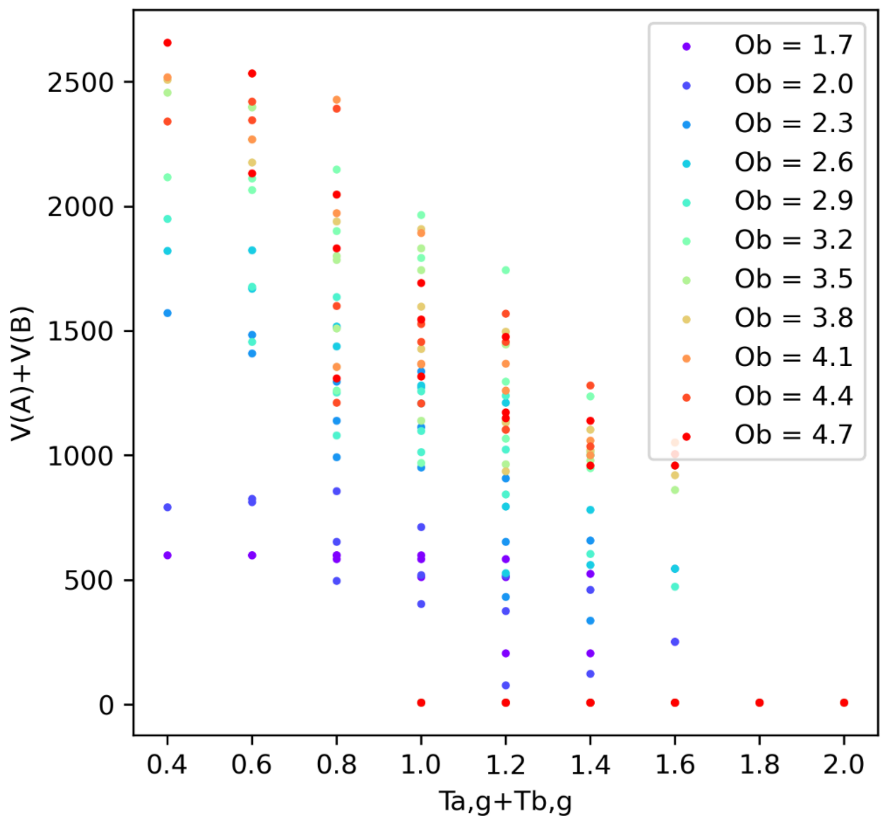

Figure S2. Influence of the concentration thresholds for growth *Ta,g* and *Tb,g* on the total volume precipitated V(*A*) + V(*B*), for *Oa* = 1.7 and different values of *Ob*. The total volume precipitated is limited by an increase of the growth thresholds.

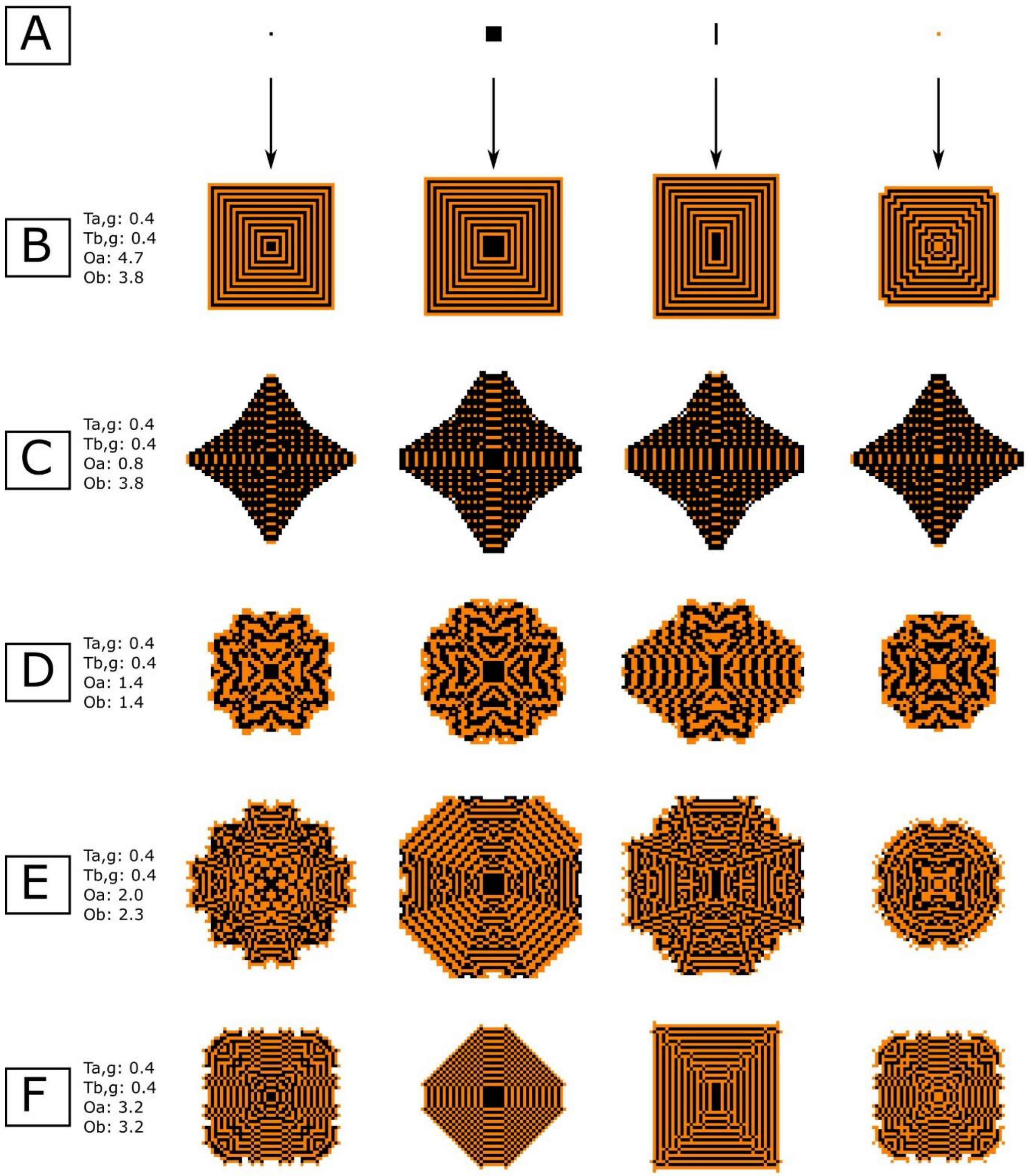

Figure S3. Influence of the morphology and phase of the nucleus on the obtained texture. Starting nuclei are shown on row **A**; from left to right, single cell of phase *A*, 5x5 square of *A*, 5x1 rectangle of *A*, single cell of phase *B.* The precipitates obtained after 10 timesteps are shown. Rows **B** to **F** correspond to different sets of conditions of *Ta,g*, *Tb,g*, *Oa* and *Ob*; columns correspond to the different starting nuclei shown on row **A**.

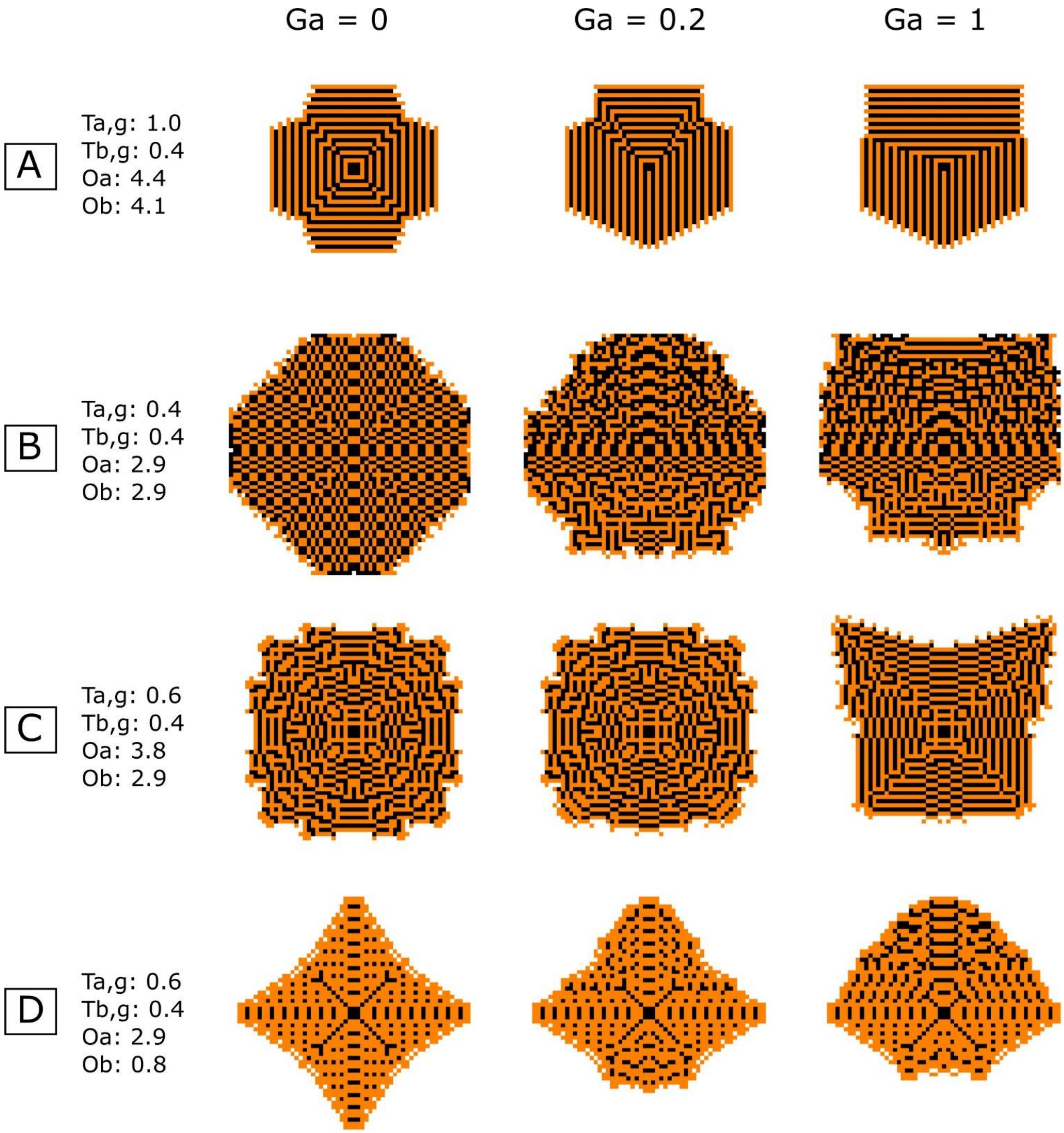

Figure S4. Effect of an initial gradient of concentration in space on the obtained texture. Four different sets of conditions of *Ta,g*, *Tb,g*, *Oa* and *Ob* are shown on the four rows. For each set of conditions, from the left to the right, gradients of *[a]* of increasing intensity (*Ga*) are used upon initiation of the simulation (see top of each column). *[a]* varies linearly from 1-Ga/2 at the bottom of the simulation space up to 1+Ga/2 at the top of the simulation space. Simulations are started from single cells of phase *A* as nuclei and precipitates obtained after 10 timesteps are shown.

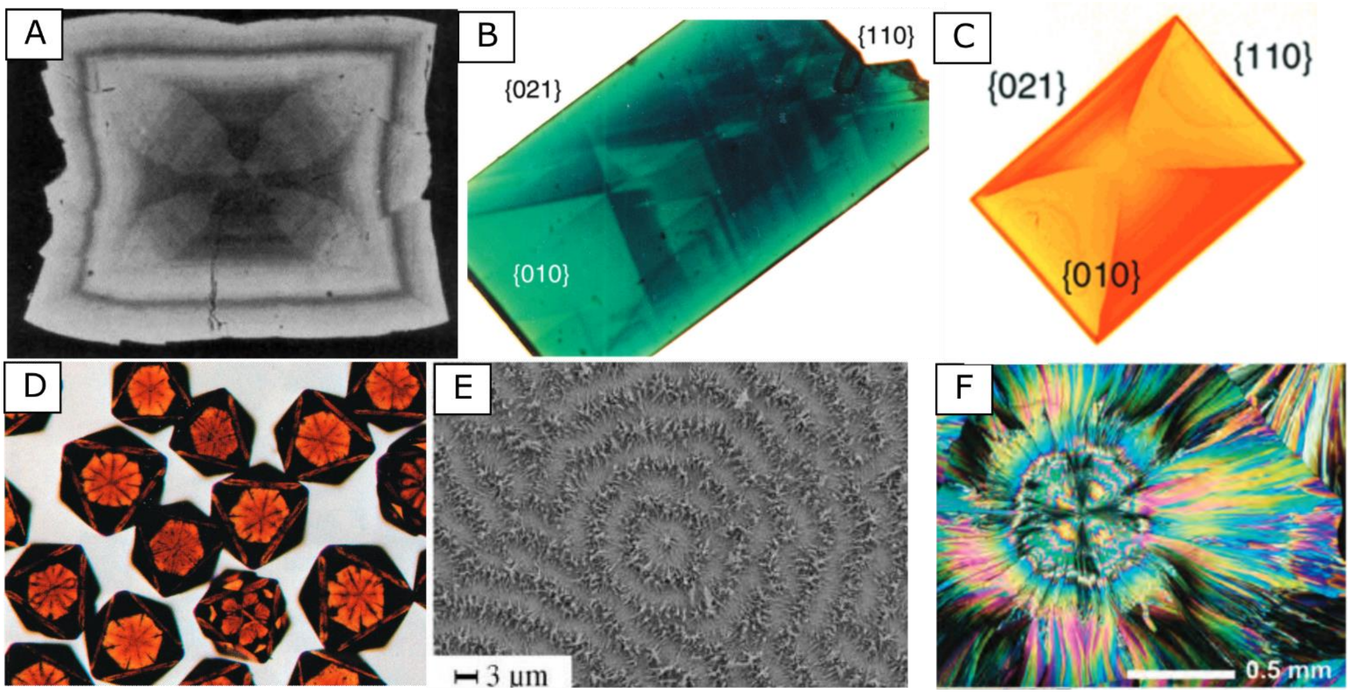

Figure S5. Examples of compositional (**A** to **E**) or orientational (**F**) ordering that may occur during the growth of single (**A** to **D**) or multiple (**E**,**F**) crystals and reported in previous works. **A**: $(Br,Sr)SO_4$ solid solution crystal (ref. 46). Darkness in the crystal is correlated to the relative proportions of Sr and Ba. **B**: Phthalic acid crystal grown in presence of methyl green dye (ref. 47). **C**: Phthalic acid crystal grown in presence of Nile red dye (ref. 49). **D**: AgBr crystals grown in presence of Maskasky dye (ref 48). **E**: Concentric rings formed by self-organization of $BaCO_3$ crystals during their growth (ref 17). **F**: Spherulitic growth and orientational pattern observed during the crystallization of hippuric acid at 80 °C (ref 50).

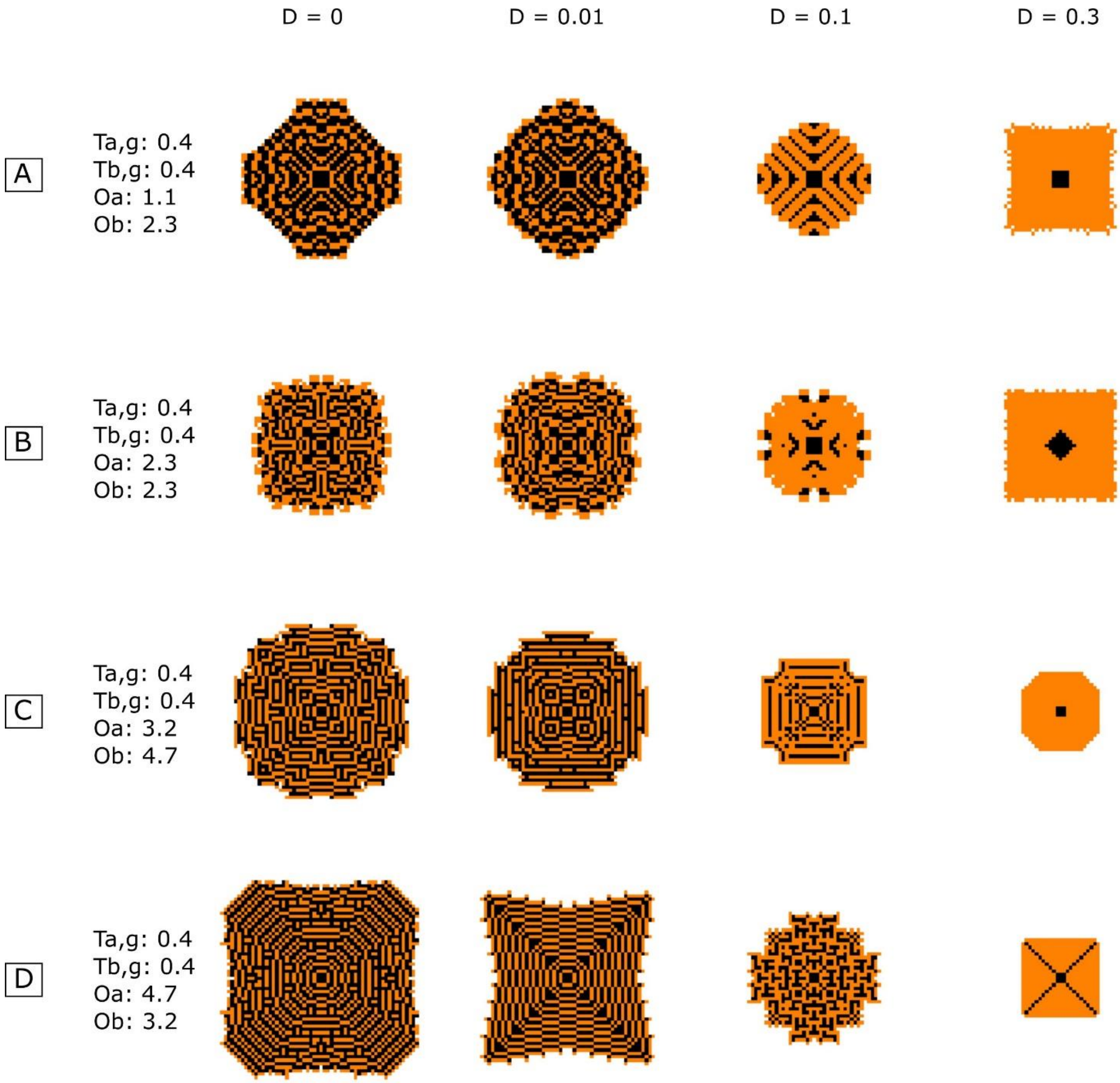

Figure S6. Effect of diffusion on the obtained texture. Four different sets of conditions of *Ta,g*, *Tb,g*, *Oa* and *Ob* are shown on the four rows. For each set of conditions, from the left to the right, increasing diffusion constants *D* are used (see top of each column). Simulations are started from single cells of phase *A* as nuclei and precipitates obtained after 10 timesteps are shown.

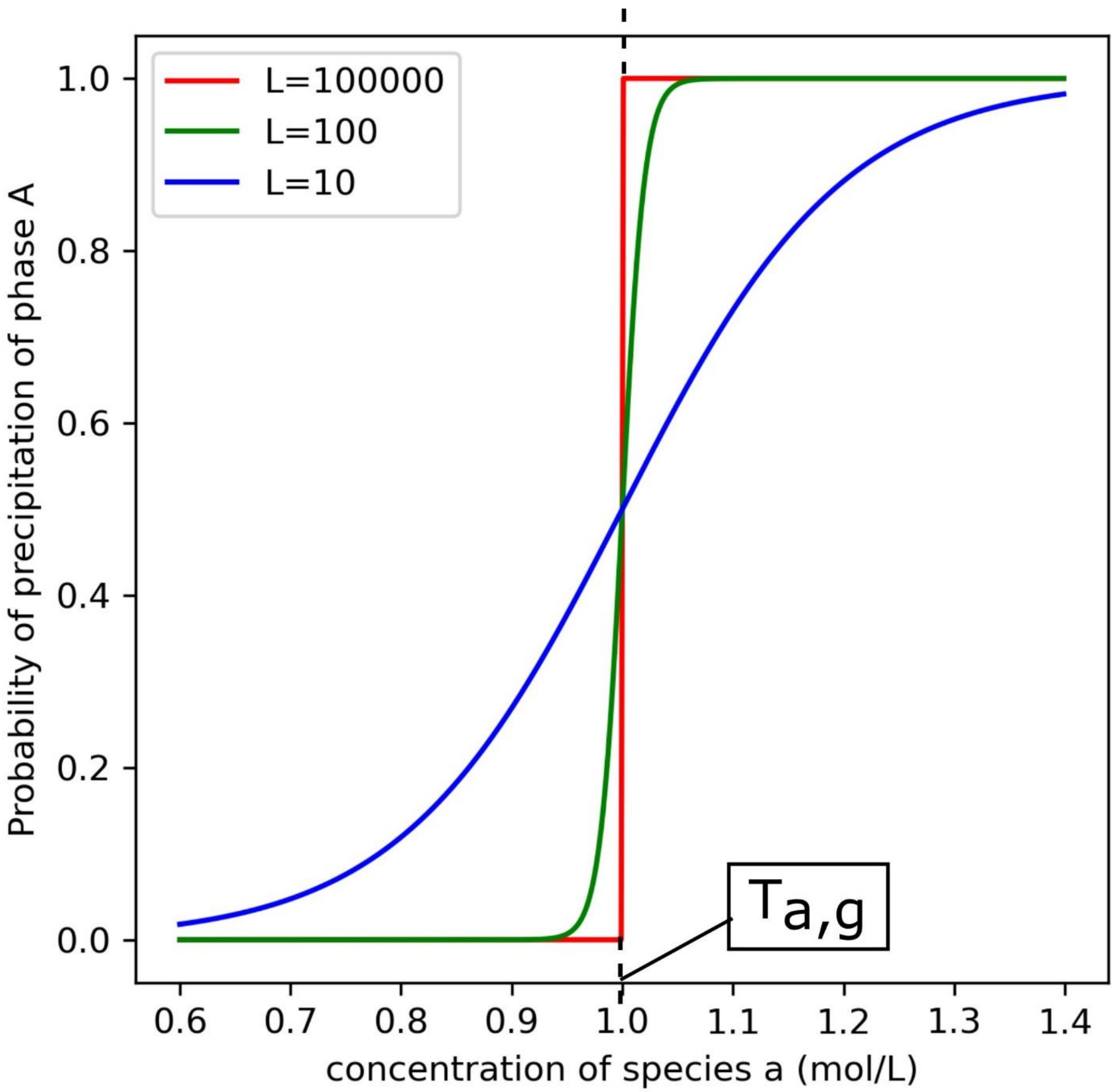

Figure S7. Probability of precipitation depending on the concentration of the dissolved species. Different sigmoidal functions are obtained using different *L* values. Higher *L* values are translated into a "steeper" threshold and consequently more determinism, whereas lower *L* values are translated into a "softer" threshold for precipitation and consequently more randomness.

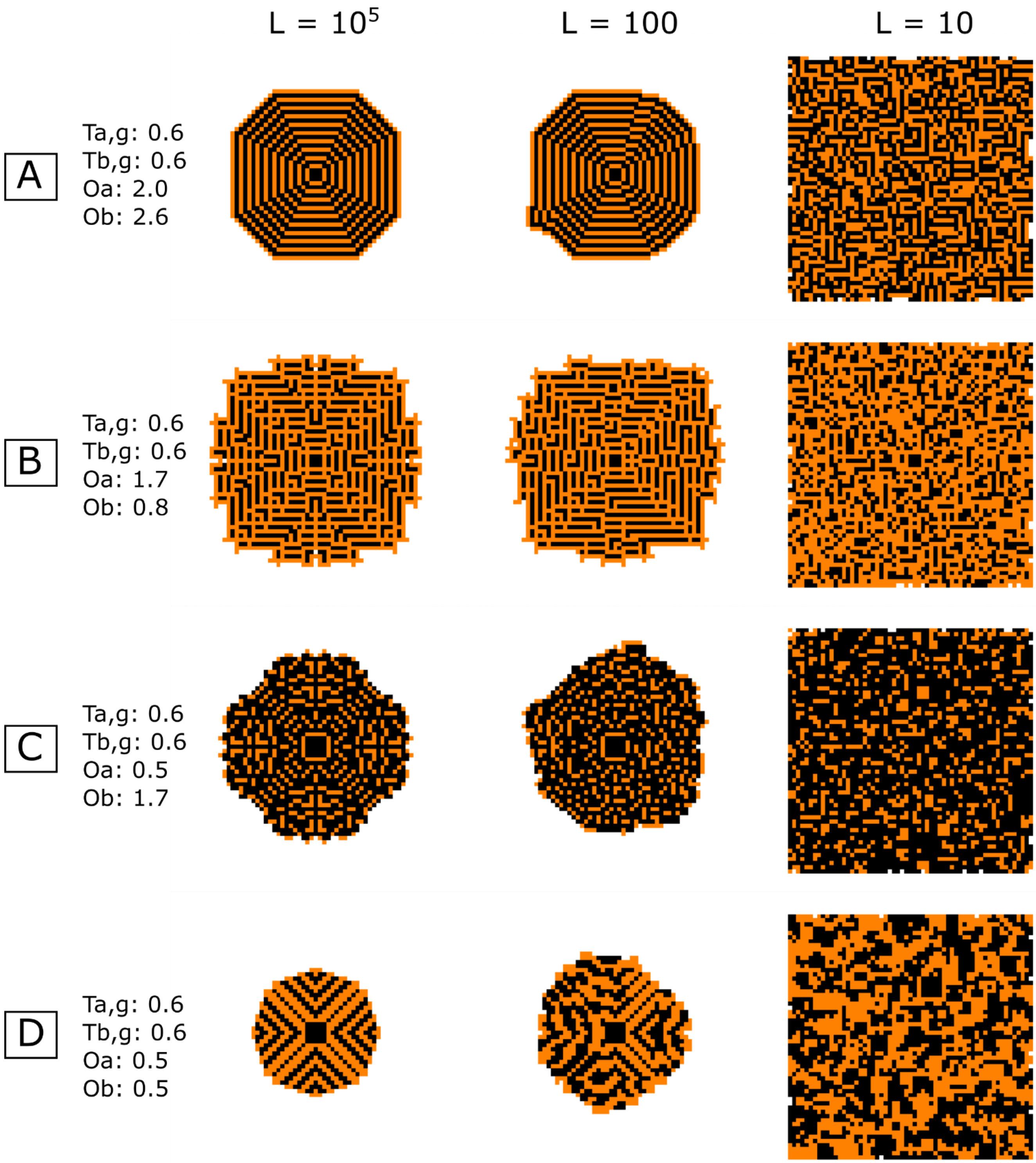

Figure S8. Effect of precipitation stochasticity on the obtained texture. Four different sets of conditions of *Ta,g*, *Tb,g*, *Oa* and *Ob* are shown on the four rows. From left to right, simulations are run using decreasing *L* values (10^5, 100 and 10, corresponding to the three curves in Fig. S7) for modelling precipitation behavior. Simulations are started from single cells of phase *A* as nuclei and precipitates obtained after 10 timesteps are shown.