**Supporting Information for**

Effect of Graphene on Ice Polymorph

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Table SI. Cubicity of the nucleation stage in each simulation trajectory.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Substrate** | ***Graphene*** | ***O-Haeckelite*** | ***R-Haeckelite*** | ***Random*** | ***Homo*** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Ice nucleation** | 8.8 | 47.4 | 61.2 | 65.5 | 33.1 |
|  | 52.0 | 56.1 | 51.1 | 16.3 | 53.1 |
|  | 20.0 | 54.4 | 28.8 | 60.9 | 52.7 |
|  | 10.2 | 54.7 | 60.0 | 62.5 | 57.5 |
|  | 41.7 | 59.9 | 66.3 | 28.5 | 57.9 |
|  | 27.6 | 51.5 | 30.2 | 66.6 | 58.0 |
|  | 30.7 | 48.4 | 56.1 | 48.4 | 55.0 |
|  | 62.2 | 51.6 | 44.7 | 72.3 | 44.7 |
|  | 32.1 | 11.3 | 54.0 | 38.2 | 42.4 |
| Cubicity / % | 50.5 | 35.8 | 53.1 | 18.2 | 60.5 |
|  | 54.8 | 38.8 | 38.2 | 46.9 | 61.1 |
|  | 18.9 | 50.0 | 20.7 | 35.8 | 45.8 |
|  | 5.0 | 32.2 | 65.0 | 50.7 | 51.0 |
|  | 37.5 | 53.5 | 50.2 | 39.0 | 58.7 |
|  | 16.2 | 57.3 | 36.2 | 61.2 | 54.9 |
|  | 49.9 | 21.7 | 45.6 | 9.3 | 56.4 |
|  | 5.1 | 22.0 | 40.8 | 8.4 | 52.5 |
|  | 23.3 | 22.5 | 44.8 | 60.9 | 51.7 |
|  | 7.5 | 31.9 | 32.1 | 31.3 | 56.1 |
|  | 49.3 | 46.9 | 48.4 | 63.2 | 44.5 |
| **Freezing** | 57.3 | 47.2 | 52.8 | 70 | 54.3 |
| **Completely** | 38.4 | 52.4 | 61.2 | 43.5 | 60.3 |
|  | 68.1 | 43.0 | 52.0 | 67.9 | 62.5 |
|  | 67.1 | 47.6 | 60.3 | 56.3 | 57.2 |
|  | 44.2 | 45.8 | 59.1 | 39.2 | 60.3 |
|  | 61.9 | 52.5 | 45.9 | 53.5 | 61.1 |
|  | 46.2 | 56.9 | 50.4 | 53.1 | 65.1 |
|  | 44.8 | 47.3 | 70.2 | 58.8 | 63.3 |
|  | 62.4 | 66.9 | 51.7 | 56.6 | 56.0 |
|  | 50.2 | 62.8 | 47.9 | 57.3 | 59.4 |
| Cubicity / % | 52.0 | 44.8 | 62.7 | 42.7 | 57.9 |
|  | 45.8 | 52.6 | 47.4 | 35.4 | 57.2 |
|  | 48.6 | 45.8 | 51.6 | 58.2 | 63.9 |
|  | 30.2 | 41.4 | 59.4 | 50.7 | 55.9 |
|  | 60.2 | 65.4 | 65 | 66.2 | 63.9 |
|  | 42.0 | 53.7 | 58.5 | 67.2 | 46.1 |
|  | 56.8 | 56.9 | 58.7 | 32.7 | 57.3 |
|  | 60.0 | 62.0 | 40.8 | 57.4 | 54.6 |
|  | 46.0 | 56.3 | 56.1 | 54.7 | 55.3 |
|  | 57.7 | 75.6 | 57.3 | 42.8 | 63.4 |

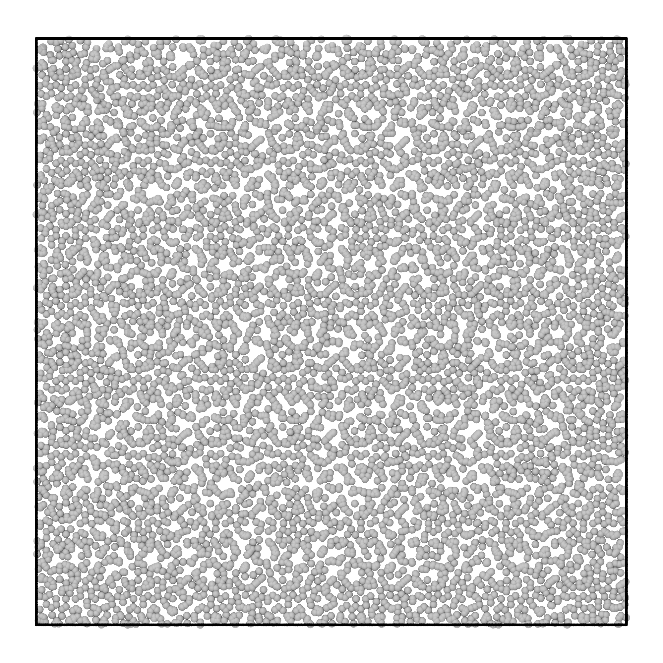


Figure S1. Surface morphology of 2-dimational carbon substrate with all the carbon atoms randomly distributed, the *Random* system.



Figure S2. Snapshots of ice nucleation on different (include *Random*)substrate.



Figure S3. Freezing efficiency Δ*T*f of different lattice structure substrate(include *Random*).