Gibbs states for super-critical Potts models on Z^2

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Abstract.

We prove that any Gibbs state of the super-critical q-state nearest neighbour Potts model on the planar lattice Z^2 is a convex combination of the q pure phases; in particular, it is translation invariant. To achieve this goal, we consider such models in large finite boxes with arbitrary boundary condition, and prove that, no matter which boundary conditions we choose, the center of the box lies deeply inside a pure phase with high probability.

Our estimate of the finite-volume error term is of essentially optimal order, which stems from the Brownian scaling of fluctuating interfaces. The results hold at any super-critical value of the inverse temperature $\beta > \beta_c(q) = \log(1 + \sqrt{q})$, and could be considered as a strong finite-volume version of Aizenman-Higuchi theorem.