

As follows from Eq. (80) the correction terms to the composition profile $\vartheta(z)$ of the mixture are of the order of e^{-2z/ξ_b} and $e^{-2\kappa z}$. Note that the effect of the charges on the profiles of the composition of the mixture is negligible in the critical region, where $\kappa \gg \xi_b^{-1}$.

IV. SUMMARY AND OUTLOOK

Starting from the lattice-gas model of a four-component mixture we have derived the continuum Landau-Ginzburg model for binary mixture solvents in the presence of ions near the critical point of the demixing transition. The model encompasses the composition of the binary solvent field ϑ , the density of ions field η and the charge density field ϕ . It takes into account electrostatic interactions and the preferential solvation. The coupling constants appearing in this extended Landau-Ginzburg theory are given explicitly in terms of thermodynamic quantities, the temperature, the mean composition of solvent, the mean density of ions, and the interaction parameters J_{ij} characterizing the lattice-gas model of a mixture. We have assumed that ions are of similar chemical nature.

The main difference between our functional and the functional studied in Ref.[9] is the presence of the term $\propto \eta^2$ and terms $\propto (\nabla\eta)^2$ and $\propto \nabla\eta\nabla\vartheta$ in (26), which result from short-range interaction potentials. These terms lead to the mixing of the fields ϑ and η in the critical order parameter. In the semi-infinite system these terms are important for the form of the profile of the field η , and through the coupling of η with the charge density ϕ in the entropy term, they influence the charge profile $\phi(z)$. In our approach, direct couplings between the charge and the concentration are disregarded, but such coupling would be present in the case of ions of different chemical nature (compare Eqs.(5) and (8)).

Mean-field theory for our Landau-Ginzburg model yields the shift of the critical point of the demixing transition with respect to the case of binary solvents without ions. The direction of the shift depends on the relative strength of the ions-solvent and solvent-solvent interaction parameters $J_{s\rho}$ and J_{ss} , and is positive for $J_{s\rho} > J_{ss}$. The linearized EL equations in the presence of a charged wall do not lead to the effect of the concentration profiles on the charge distribution. We treat nonlinear effects using a perturbation expansion, which gives the simple expression for the leading correction to the solution of the linearized EL Eqs.(74) and (75). The ratio between the next-to-leading and leading terms is proportional to the