COLIBABA, G.V. Halide-oxide carbon vapor transport of ZnO: Novel approach for unseeded growth of single crystals with controllable growth direction. In: Journal of Physics and Chemistry of Solids. 2018, Vol.116, pp. 58-65. ISSN 0022-3697.

The thermodynamic analysis of using HCl + CO gas mixture as a chemical vapor transport agent (TA) for ZnO single crystal growth in closed ampoules, including 11 chemical species, is carried out for wide temperature and loaded TA pressure ranges. The advantages of HCl + CO TA for faster and more stable growth are shown theoretically in comparison with HCl, HCl + H_2 and CO. The influence of the growth temperature, of the TA density, of the HCl/CO ratio, and of the undercooling on the ZnO mass transport rate was investigated theoretically and experimentally. The HCl/CO ratios favorable for the growth of *m* planes and (0001)Zn surface were found. It was shown that HCl + CO TA provides: (i) a rather high growth rate (up to 1.5 mm per day); (ii) a decrease of wall adhesion effect and an etch pit density down to 10^3 cm^{-2}; (iii) a minimization of growth nucleus quantity down to 1; (iv) stable unseeded growth of the high crystalline quality large single crystals with a controllable preferred growth direction. The characterization by the photoluminescence spectra, the transmission spectra and the electrical properties are analyzed.