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Universal structural and dynamic features in metals near their melting points

Khusnutdinoff R M

Kazan Federal University, Kremlyovskaya Street 18, Kazan, Tatarstan 420008, Russia

khrm@mail.ru

This paper presents the results of a comparative analysis of experimental data on the structural and dynamic properties and characteristics of liquid alkaline (Li, Na, K), alkaline earth (Mg, Ca, Sr) and transition metal groups—elements of the subgroups of nickel (Ni Pd, Pt) and copper (Cu, Ag, Au)—near their melting points. Reduced spatial $r/r_m = rk_m/(2\pi)$ and time $t/t_m = tk_m/\sqrt{m\beta}$ scales, in which k_m is the position of the main maximum of the static structure factor $S(k)$ and $\beta = 1/(k_BT)$ (k_B is the Boltzmann constant) is the inverse temperature, are introduced as the basis for the law of corresponding states. Based on these scale transformations and experimental data on x-ray diffraction, it was found that the groups of liquid alkaline, alkaline earth, and transition metals are described by universal r and k-dependencies. It has been established that the dispersion law of longitudinal polarization $\omega_c(k)$, given in accordance with these scale relations, for elements of groups of liquid alkaline, alkaline earth and transition metals has a single universal character. An analysis of the properties of three groups (alkaline, alkaline earth and transition) liquid metals using scale transformations shows that the law of the corresponding states is valid for these substances.

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