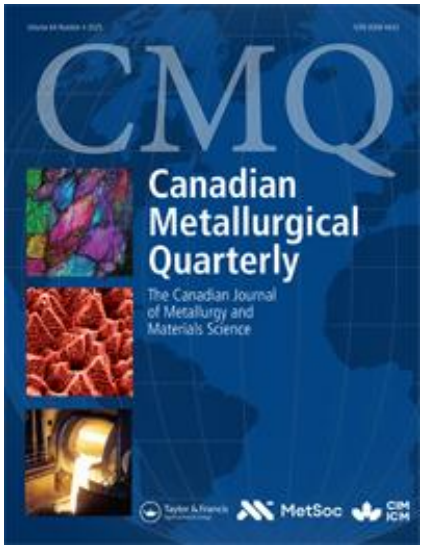

Canadian Metallurgical Quarterly

The Canadian Journal of Metallurgy and Materials Science

[a] Gigo Jandieri, https://orcid.org/0000-0003-2976-1201
[a] David Sakhvadze,
[b] Besik Saralidze &
[c] Giorgi Sakhvadze

[a]Rafiel Dvali Institute of Machine Mechanics, Tbilisi, Georgia;
[b]Ferdinand Tavadze Institute of Metallurgy and Materials Science, Tbilisi, Georgia;
[c]Metal Powders LTD, Tbilisi, Georgia

Investigation of the physico-technological features of the hydro-vacuum cleaning process for the high-entropy alloy CoCrFeNiMn produced from industrial ferroalloys

Received 03 Mar 2025, Accepted 29 Sep 2025, Published online: 18 Oct 2025
https://doi.org/10.1080/00084433.2025.2571297

ABSTRACT

This study reveals the hydro physical mechanism of hydro-vacuum, shockwave and cavitation-pulsation counter gravity flotational extraction of non-metallic micro inclusions inherent in the liquid high-entropy alloy CoCrFeNiMn (HEA) obtained by an original method of combined induction remelting of low- and carbon-free ferroalloys with an elevated content of target metals. The effectiveness of the hydro-vacuum technology of vertical suction, confuser-convective acceleration, and diffusion-hydro mechanical dispersion of an upward flow of molten metal superheated by 100–150 °C is theoretically substantiated and experimentally proven. It has been established that vortex-like radial twisting of tangentially directed cavitation currents in the thrust-forming high-speed annular flow of water-liquid-metal pulp formed in the process of counter-gravity acceleration, with subsequent asymmetric slamming of the caverns formed in it, is the main conditioning factor for generation of ultra-frequency shock waves of rarefaction and flotational supplanting of relatively light nonmetallic inclusions from atomised drop-liquid particles of HEA. The powder obtained by the proposed method, by its purity 98.7–99.4% and hardness 250–300 $HV_{0.5}$, is practically identical to similar high-entropy materials synthesis,ed from pure metals. The findings can contribute to stimulating the development of the proposed cost-effective and easily scalable approach to the production and cleaning of HEAs of different systems.

KEYWORDS:

- **High-entropy melt**
- **nonmetallic micro inclusions**
- **hydraulic thrust-forming rarefaction**
- **counter gravitational atomisation**
- **separation**

Article Views: geographical distribution

Top 5 country %

Germany 57% China 16% Georgia 8% Spain 4% Hong Kong 4%