

ISOTOPE SEPARATION BY DC ARC DISCHARGE

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We are investigating about possibilities of application of plasmas in the field of nuclear fuel processing and reprocessing. Here, we introduce one of the interesting topics, the isotope separation by DC arc discharge.

When a DC arc discharge is drawn across a thin capillary between electrodes under the conditions of the discharging pressure about 10 Torr using gaseous neon, the cathode region becomes enriched in a heavy isotope ^{22}Ne , while the anode region becomes enriched in the light isotope ^{20}Ne . We study the separation characteristics of the neon isotopes under closed-system conditions experimentally. We develop an apparatus to make the stable DC arc plasma for a sufficiently long time, and investigate the effects of the length of the capillary, the discharge current, and the discharging pressure, on the equilibrium concentration.

We derive the equation which gives the enrichment factor from the experimental parameters by modifying one of the theoretical equations proposed. The observed enrichment factor is well explained by the equation. It is approximately described by the dimensionless amount $(IV_c)/(PSv_{ed})$, where I is the discharging current, V_c the voltage drop at the capillary, P the discharging pressure, S the cross section of the capillary, and v_{ed} the electron drift velocity. The maximum separation factor obtained in the present experiment is 1.072 when $P=5$ Torr.