Suszeptibilität erst während der Erstarrung der Erstarrung der Legierung (Kurve 5).

Gleiches Verhalten wird auch bei einer Gold-Kobalt-Legierung mit der Zusammensetzung des Eutektikum von 27 At.% Co festgestellt (Fig. 2). Die spezifische Suszeptibilität der Legierung befolgt im flüssingen Zustand ein Curie-Weiss-Gesetz. Bei der Abkühlung steigt mit Beginn der eutektischen Erstarrung die Suszeptibilität sehr stark an. Im Gegensatz dazu fällt bei einer χ-T-Aufheizkurve dieser Probe die Suszeptibilität erst bei höheren Temperature auf den Gleichgewichtswert ab, obwohl die Legierung bereits bei 996°C aufgeschmolzen ist, wie sich aus der thermischen Analyse ergibt. Der Suszeptibilitätsabfall ist von der Aufheizgeschwindigkeit abhängig. Diese ist zusammen mit der Überhitzungstemperatur entscheidend für die Auflösungsgeschwindigkeit der kobaltreichen Phase in der Schmelze.

Die Auswertung der χ-T-Kurve der flüssigen Gold-Kobalt-Legierung (Fig. 2) ergibt eine paramagnetische Curie-Temperatur $\theta_p = 610^{\circ}C$ und ein effektives auf Co bezogenes magnetisches Atommoment von $p'_{eff} = 3.45 \cdot \mu_B$, in Übereinstimmung mit von Weil [5] durchgeführten Messungen.

Nakagawa [6] teilte kürzlich ähnliche Ergebnisse magnetischer Messungen an Gold-Kobalt-Legierungen mit 30 und 40 At.% Co mit und folgerte ebenfalls, dass diese flüssigen Legierungen nicht ferromagnetisch sind.

Diese nicht unerwarteten Ergebnisse stehen im Widerspruch zu einer Veröffentlichung von Busch und Guentherodt [7], nach der Gold-Kobalt-Legierrungen in der Nähe der eutektischen Konzentration (27 At.% Co) im flüssigen Bereich Curie-Temperaturen aufweisen sollen.

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EXTRACTION OF ELECTRONS FROM QUANTIZED VORTEX LINES

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If electrons are trapped in vortex lines of rotating He II, they can emerge into the vapor phase without overcoming any detectable energy barrier. This observation of the extraction of electrons from straight vortex lines above 1.1°K agrees very well with the evaporation of electrons from vortex rings studied by Surko and Reif below 0.7°K

To extract electrons from the bubble state in stationary liquid helium into the gas phase one must overcome a potential barrier of 25°K for temperatures between 1.6°K and 1.1°K, where the measured currents became vanishing small [1]. This barrier was mainly attributed to the image-force potential acting on a charge in the vicinity of an interface between two media of different dielectric constants. However Surko and Reif [2] recently reported that below 0.7°K electrons can emerge from the liquid surface without overcoming any noticeable barrier if they are trapped in vortex rings. This letter reports on an experiment where electrons are captured by vortex lines in rotating He II and then are drawn into the gas phase along the vortex core.

The experimental cell is shown in fig. 1. At the bottom of the rotating bucket, a negative ion beam is produced in the usual manner by a radio-

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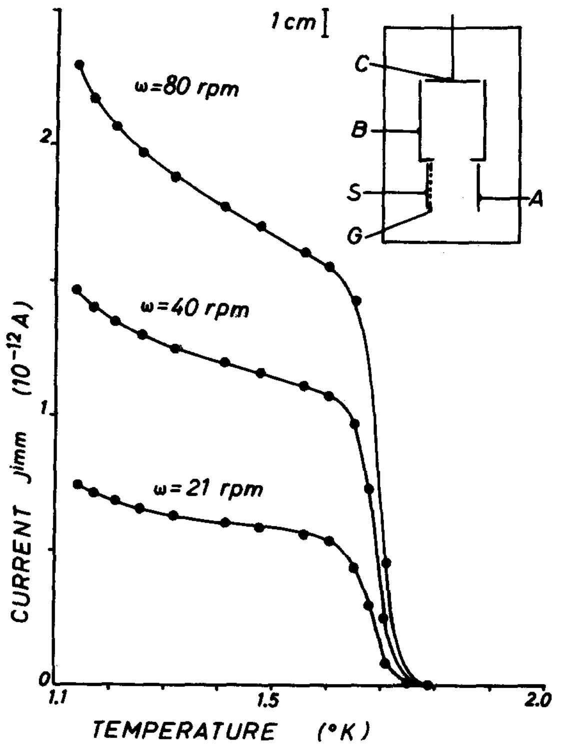

Fig. 1. Current at collector C as a function of temperature for different rotation frequencies ω. Insert: Electrode structure of the measuring cell.

active source S, a grid G and a plate A. The current was measured at collector C which was shielded by tube B. A, B and C were grounded. An electrometer amplifier was mounted on the rotating axis at the top of the cryostat. The bucket was filled with liquid helium with the liquid level either above or below the collector. In either case without rotation no current was detectable at the collector (less than 10^{-14}A) whereas with rotation, the ions are captured by the vortex lines and move along the core due to the presence of parallel electric field components. Evidently, only electrons trapped on vortex lines contribute to the collector current.

Fig. 1. shows the current j^{imn} arriving at the collector, immersed in the liquid, as a function of temperature for different rotation frequencies ω. Between 1.8°K and 1.6°K the curves exhibit the sharp temperature dependence of the effective cross section for ion trapping. The slight rise below 1.6°K is probably due to the increasing mobility. In the case when the liquid surface was below the collector, the corresponding currents $j^{\mathrm{not\ imm}}$ were nearly identical to j^{imm}, that is

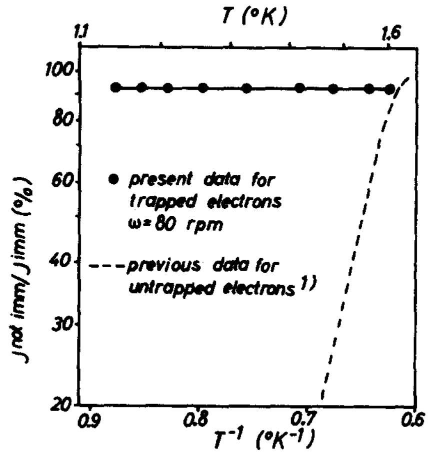

Fig. 2. Current across the liquid surface normalized to current in the liquid as a function of the reciprocal temperature. (Deviation from 100% is due to charge leakage in vapor to guard electrode B.)

they had the same temperature dependence and their absolute values ranged from 82% to 100% j^{imm}, depending slightly on the separation between the collector and the liquid surface because a fraction of the electrons in the gas could leak to the tube B. (The separation ranged from 1 mm to 3 mm). In fig. 2 as an example for ω = 80 rpm the normalized currents $j^{\mathrm{not\ imm}}/j^{\mathrm{imm}}$ are plotted as a function of the reciprocal temperature. The temperature independence of this ratio clearly shows the absence of any Boltzmann factor exp $(-\phi/kT)$ for $\phi/k \gtrsim 0.5$°K. Hence we conclude that *trapped* electrons can emerge along the vortex cores into the vapor without encountering a potential barrier greater than 0.5°K.

An understanding of the mechanism of the electron ejection involves a detailed model of the vortex core including the question to what degree the vortex core is empty or filled with normal fluid. In this experiment the vanishing surface barrier seems to confirm the assumption [2] that the electrons indeed emerge along paths of low density.

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