3. Versetzungen, die ähnlich wie Bausteine abweichender Größe Gitterverzerrungen und damit Feldgradienten erzeugen.

Herrn Prof. Dr.-Ing. W. MIALKI bin ich für sein förderndes Interesse sowie dem Berliner Senator für Wissenschaft und Kunst für die finanzielle Hilfe zu Dank verpflichtet.

Resonance Capture of Slow Electrons in Ethane

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(Z. Naturforsch. **23 a**, 1228—1229 [1968]; received 11 July 1968)

GRÜNBERG [1] has found that the drift velocity of electrons at room temperature in hydrogen and nitrogen at a given E/p (E field strength) is dependent on the pressure p. For example at $E/p=0{,}03$ [V/cm·Torr], the drift velocity v_- in H_2 decreases to 78% of its value at $p=775$ Torr, if one measures at $p=31\,350$ Torr. In N_2 he found a similar effect (but not so strong). To obtain a better insight into the physical process it was of interest to measure the p-dependence in other gases.

The value of v_- in ethane (C_2H_6), obtained by the method described in [1], is given in Table 1 as function of E/p at a pressure of 900 Torr. If one measures at different pressures between 600 and 24 000 Torr and plots v_- at this pressure divided by v_- at 900 Torr [$v_-(p)/v_-(900)=q$] as function of E/p, one obtains Fig. 1. It demonstrates, that q decreases with smaller E/p, the more the higher the pressure, as was found in

$E/N \cdot 10^{18}$ [V·cm²]	E/p [V/cm·Torr]	$v_- \cdot 10^{-5}$ [cm/sec]
1	0,033	3,66
2,2	0,073	8,65
3,6	0,119	14,2
6	0,198	24,8
8	0,264	30,4
10	0,33	33,9
22	0,73	47,6
36	1,19	51,3
60	1,98	53,9
80	2,64	55,2
100	3,30	54,6

Table 1. Drift velocity in ethane measured at 20 °C and $p=900$ Torr. The error of the v_--values is 3%.

$N \cdot 10^{-20}$ [cm⁻³]	p [Torr]	q	$\left[\frac{1-q}{p \cdot q}=c\right] \cdot 10^6$
1,5	4 550	0,96	9,2
4	12 140	0,90	9,2
5	15 180	0,88	9,0
7	21 250	0,82	10,3
8	24 290	0,81	9,7

Table 2. Relative drift velocity q at $E/p_{20}=0{,}2$ [V/cm Torr].

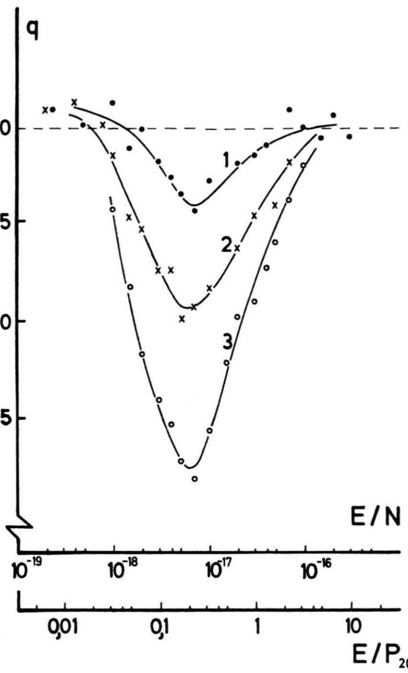

Fig. 1. The dependence of ratio $q=v_-(p)/v_-(900)$ on E/N with density N as parameter (N=measured density, p=pressure of the ideal gas of the same density at room temperature).
Curve 1: $N=1{,}5 \cdot 10^{20}$ cm⁻³, $p=4\,554$ Torr,
Curve 2: $N=4 \cdot 10^{20}$ cm⁻³, $p=12\,143$ Torr,
Curve 3: $N=7 \cdot 10^{20}$ cm⁻³, $p=21\,251$ Torr.

H_2 and N_2. Moreover and that is a new result, q passes a minimum with decreasing E/p and reaches again the value 1 at still lower values of E/p. The minimum of q is the lower the higher the pressure (see Table 2). To explain this result one can assume that the electron is attached for a short time τ by the ethane molecule. The curves in Fig. 1 show at a given pressure a resonance-like dependence on E/p. This behaviour can be understood, if τ depends on the electron energy in a similar manner. The resonance peak becomes more prominent the higher the pressure. Applying this model one obtains for the drift velocity

$$v_-(p)=v_-(p_0)\cdot(1+\nu\cdot\tau)^{-1},$$

where $\nu=\nu_1 \cdot p$ is the frequency of trapping collisions, $v_-(p_0)$ the drift velocity with negligible capture [2]. From this relation follows that the ratio $q=v_-(p)/v_-(900)$ is connected with p by $(1-q)/p\,q=\text{constant}=c$, which is in agreement with the experiments, see Table 2.

The maximum of τ lies at $E/p=0.2$ [V/cm·Torr] and corresponds to a mean electron energy of 30 – 100

[1] R. GRÜNBERG, Z. Phys. **204**, 12 [1967].

[2] See e.g. R. H. RITCHIE and J. E. TURNER, Z. Phys. **200**, 259 [1967].

meV. With an assumed cross section of 10^{-16} cm^2 the value of τ becomes in its maximum about 10^{-13} sec. More detailed experiments are necessary to understand this resonance interaction at these very low electron energies.

Apparently similar processes produce the decrease of v_- in H_2 and N_2; however, the minima of q lie probably at lower energies in the region of the thermal velocity, so that Grünberg did not reach the minimum and the comeback to $q=1$.

The author thanks Prof. Dr. H. RAETHER for his suggestion and support of this work and Dipl.-Phys. R. GRÜNBERG for his experimental assistance.

The $^{12}C(n,\alpha_0)^9Be$ Reaction at 13.9 and 15.6 MeV

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(Z. Naturforsch. **23 a**, 1229—1230 [1968]; received 15 June 1968)

The investigation of (n,α) reactions has previously shown that both compound and direct processes are involved. The energy and angular distributions of the alpha particles from (n,α) reactions on heavy nuclei at 14 . . . 16 MeV show that the direct mechanism predominates [1, 2]. In the case of medium mass nuclei, evaporation spectra and angular distributions which are symmetrical about 90° are observed. However, the few angular distributions of ground state transitions, which have previously been measured, indicate the (n,α_0) reaction to be a direct process even in this region of mass numbers [3, 4]. In the case of light nuclei it is less difficult to separate different alpha particle groups. Angular distributions corresponding to defined states of the final nucleus may therefore be obtained. In addition to information about the reaction mechanism, spectroscopical results may also be expected.

During the last year, some (n,α) reactions on light nuclei have been studied with neutrons near 14 MeV [5, 6]. In the present work, the differential cross section of the reaction ^{12}C(n,α_0)^{9}Be has been measured at 13.9 and 15.6 MeV.

The neutrons were generated by the ^{3}H(d,n)^{4}He reaction, using a Van de Graaff accelerator. The neutron current density at the carbon target was approximately $5\cdot10^6$ sec^{-1} cm^{-2}. Natural carbon targets of 0.4 mg $\cdot$cm^{-2} and 1.0 mg$\cdot$cm^{-2} thickness were used with tantalum as a backing. In order to correct for the background, each carbon run was followed by a background run with the carbon target replaced by a tantalum target.

The alpha particles were detected with a counter telescope in which two proportional counters filled with 150 Torr CO_2 were followed by a Si semiconductor detector [7]. The angular distribution function of the telescope was calculated with a Monte-Carlo-technique. The full width at half maximum is typically 15°.

The proportional counter pulses were added to give a single ΔE-pulse. This was analysed in a two-dimensional pulse height analyser together with the E-pulses from the semiconductor detector. The resolution was 32 channels for the ΔE-pulses and 128 channels for the E-pulses. Timing information was obtained from each of the three counter pulses by means of the zero-crossing method. The gate of the analyser was opened by the presence of a triple coincidence; the resolution time was 100 nsec. For 5 MeV α-particles, the resolution is approximately 10% in the ΔE-channel and is better than 100 keV in the E-channel. For alpha particle energies greater than 2.5 MeV, the detection efficiency is 100%.

A long counter was used as a neutron monitor. In order to obtain the neutron current density in the position of the carbon target, it was replaced by a helium gas target. The recoil alpha particles were thus detected in the same arrangement as the alpha particles from the (n,α) process. The differential cross section for the elastic n-^{4}He-scattering was calculated from the phase shifts of HOOP and BARSCHALL [8].

Fig. 1 shows the energy spectrum of the alpha particles from the reaction ^{12}C+n at a telescope angle of 0° and with a carbon target thickness of 400 μg $\cdot$cm^{-2}. The mean neutron energy was 13.9 MeV; upper and lower limits were 14.05 MeV and 13.75 MeV. The ground-state transition of the reaction ^{12}C(n,α)^{9}Be is clearly separated from the lower part of the spectrum; the α_1-, α_2- and α_3-groups are visible as well. At the lower energies however, alpha particles of the 3 α breakup reactions [9] contribute to the spectrum of the ^{12}C(n,α)^{9}Be reaction. The difference in energy between the ground state: ^{9}Be+α and the state: 3 α+n is 1.5 MeV approximately. Therefore only the α_0 transition has been analysed.

Alpha particle spectra of the reaction ^{12}C(n,α)^{9}Be have been measured several times [10–13]. However, the experimental techniques used (emulsion technique [10, 11],

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