particles leading to the ground state and the excited sttes of Mg^{25} from the reaction $Al^{27}(d, \alpha)Mg^{25}$ with 14.7 MeV deuterons, by using a semiconductor detector of p-n junction. The differential cross-sections of the reactions leading to the single levels of Mg^{25} are compared with a formula obtained from the two-nucleon pick-up theory. The experimental angular distribution for each alpha group with a comparatively large cross-section is in agreement, at least in forward angle, with the theoretical curve. The alpha group leading to the 3.4 MeV level of Mg^{25} is considered to come from the transition to the 9/2+ state rather than to the 3/2- state. The total cross-sections for the levels of Mg^{25} corresponding to the same K-band 5/2+ as that of the ground state of Al^{27} are larger than the others.

Viscoelastic Properties of Asphalts

Hiroshi AIDA

Journal of Japan Petrolium Institute, 4, 845 (1961)

Viscoelastic propertis of several kinds of asphalts were measured by a cone-and-plate type viscometer. The viscosity coefficients, the delayed elastic compliances at steady state, and the retardation spectra were obtained from the strain-time and recovery curves at various temperatures.

The following results were obtained: (1) The viscosity coefficients when expressed by Andrade's equation gave the apparent activation energies as 30~40 kcal/mole. (2) The delayed elastic compliances at steady state were in the order of $10^{-6}cm^2/dyne$ and increased with the rise in temperature. (3) When time-temperature superposition principle was applied to the asphalt, the apparent activation energies for retardation process were 20~28 kcal/mole. (4) The retardation spectra were wedge type with a slope of about 0.4 on logrithmic scales independent to the kinds of asphalts, and the maximum value of each spectrum shifted to the longer time with decrease of resins to asphaltenes or oil to asphaltenes ratio.

Viscoelastic Properteis of Bentonite Pastes

Hiroshi AIDA, Tetsuya HANAI and Rempei GOTOH

Nippon Kagaku Zasshi, (*Journal of the Chemical Society of Japan, Pure Chemistry Section*) 83, 536 (1962)

Viscoelastic properties of several kinds of bentonite pastes were measured under a constant shearing stress by use of a cone-and-plate type viscometer. It was found that the paste had two threshold values of shearing stress which were

named lower limit and upper limit, and that the viscoelastic behavior appeared markedly between these two limits.

Below the lower limit of stress no deformation was observed. The bentonite in swelling liquids shwed the viscoelastic behavior different from that in non-swelling liquids. The upper limit was assumed to be a value above which local breakdown of the structure of paste occurs. This upper limit was compared with the critical value obtained from a uniaxial compression test and that from a direct shear test used in soil mechanics. The upper limit $\sigma_2{}^*$ was related to the shear fracture, and was expressed experimentally by the following equation,

$$\sigma_2{}^* = A \exp (k \cdot C)$$

where C the concentration of bentonite and A and k were constants. $\sigma_2{}^*$ takes higher value in swelling liquids than in non-swelling liquids.

Effect of Adjacent Group on the Rocking Frequencies of Methyl Group

Tohru Takenaka and Rempei Gotoh

The CH_3 and CD_3 rocking frequencies, γ_{CH_3} and γ_{CD_3}, of $(CH_3)_n XH_{m-n}$ molecules and their deuterium derivatives are studied in relation to the type of X atom in groups IV∼VII of the periodic table, where m is the valence of X atom and n an integer from 1 to m. The frequency shifts are ascribed to changes in the force constant for the deformation of HCX angle, and can be expressed as

$$\gamma_{CH_3} = 582 \log (x_X/r_{CX}{}^2) + 1045$$
$$\gamma_{CD_3} = 416 \log (x_X/r_{CX}{}^2) + 778$$

for all undeuterated and deuterated molecules examined except for some cases where considerable coupling exists between the rocking and other modes of vibrations. Here x_X represents the electronegativity of X atom and r_{CX} the C-X bond length. The relation between two formulae can be theoretically interpreted by taking into consideration the change of the kinetic energy matrix on deuteration of the methyl group.

If these formulae and similar ones previously proposed by one of the authors for the symmetrical deformation frequencies are assumed to hold for the molecules such as CH_3NO_2 and CH_3CCl_3, the group electronegativity of the radical directly bonded to the methyl group is derived from the frequencies observed for the molecule. The results are compared with other sets of the values obtained empirically from various spectroscopic relations.