

on increase of pressure transforms by a *first order* change into a new *LS* phase, which has the compressibility of the solid phase, but exhibits a greatly lowered viscosity compared with that of the liquid from which it is formed by compression and the addition of heat. The internal energy increase and the increase of entropy when this phase expands are excessively large. In the transformation of the L_2 to the solid *S* phase there is no latent heat, so the change is second order.

Mr. Eyring considered the viscosity of monolayers from the theory of absolute reaction rates.

A decrease in viscosity with increase in pressure indicates that the activated state occupies a smaller area than the initial state, and vice versa. Similarly a decrease in viscosity with temperature indicates that the activated state has a greater energy than the initial state; and increase in viscosity with temperature that the activated has less energy than the normal state.

A thermodynamical theory of the spreading of liquids on surfaces was presented by Prof. Harkins.

(1) A duplex (*D*) or thick film may spread if its spreading involves a decrease of free energy. On water a *D* film is always unstable, since there is a decrease of free energy when it transforms into a monolayer (*M*) and a lens.

(2) Water and all oils spread on mercury, and all liquid oils on water to give monolayers, but if a duplex film cannot spread the pressure (π) of the monolayer may be small.

(3) $\pi_e = S_{b'/a} - S_{b/a}$ or the semi-initial minus the final spreading coefficient. Since $S_{b'/a}$ is always negative, π_e , the equilibrium pressure, is

always greater than the semi-initial spreading coefficient, and almost always greater than $S_{b/a}$, the initial coefficient for the spreading of the dry oil (*b*) on clean water (*a*) as a duplex film.

(4) Water does not spread as a duplex film on any oil.

(5) It always takes *less* work to pull any oil from its first complete monolayer on water than to pull the oil apart.

(6) While lower hydrocarbons give duplex film spreading on water, higher hydrocarbons and some polar oils (as methylene iodide) do not, but form monolayers only.

Dr. Irving Langmuir, of the General Electric Co., discussed the permeability of monolayers.

Copper gauze supporting a layer of $\text{CaCl}_2 \cdot a\text{H}_2\text{O}$, mounted at a distance *b* above the surface of water in a film trough is used to measure the rate of evaporation. At equilibrium, the rate at which water escapes is determined by the resistance of the moisture-saturated air in the space between the liquid surface and the adsorbent. This resistance to diffusion, ω , is given by $\omega = Awt/M = b/D$, where *A* is the surface area evaporating, *w* the grams of water per unit volume of saturated air, *t* the time in seconds, and *M* the mass evaporated; *D* is the diffusion coefficient. A monomolecular film of an acid, alcohol, cholesterol or ergosterol placed on a clean water surface gives an increase in ω , but proteins do not. A logarithmic relation is found between ω and the film pressure. The permeability exhibits extreme sensitivity to impurities. Langmuir considers an impermeable film to be tightly packed at some *definite height in the film*.

NEWS AND VIEWS

In Defence of Liberty

LAST week, on the outbreak of war between the United States and the Totalitarian Powers, the King sent a message to President Roosevelt, which concluded with the words: "We share your inflexible determination and your confidence that, with God's help, the powers of darkness will be overcome and the four freedoms established throughout a world purged of tyranny." President Roosevelt, in his reply, paid a tribute to the courage of the British people during the past two years, and said: "The forces which have plunged the world in war, however strong, cannot prevail against the indomitable strength of free peoples fighting in a just cause."

This was also the text of President Roosevelt's stirring radio address to the American peoples on December 15, the one hundred and fiftieth anniversary

of the adoption by Congress of the Bill of Rights. The basic principles of the freedom of man embodied in the Bill have been accepted by all the republics of the Western hemisphere, and indeed by some four fifths of the peoples of the world. The present struggle is nothing less than an attempt on the part of the Totalitarian Powers to overthrow all the results that have flowed from the gradual growth of the liberty of the individual. It is an attempt to impose once more on mankind the tyranny and despotic rule of the Middle Ages, from which we have been set free by the courage and sacrifice of our ancestors. The present generation of Americans, President Roosevelt said, are as determined to preserve liberty as their ancestors were to win it, and he pledged Americans not to lay down the arms they have now taken up until liberty is once more secure in the world.