as shown in the paper mentioned already and β'_1, β'_2 and β'_{12} are closely related to the three-dimensional virial coefficients.

These equations are very similar to those for adsorption from a single gas, namely,

$$\log x/p = K(T) - K_1 x - \ . \quad . \quad . \quad . \ ,$$

but K_1 is, in the case of mixtures, a function of the composition of the adsorbed phase. For low surface concentrations we obtain the well-known results

$$x_1/p_1 = k_1(T) \qquad x_2/p_2 = k_2(T).$$

By suitable approximations these virial adsorption isotherms can be converted into the Langmuir isotherm for mixtures

$$x_1 = \frac{a_1\, b_1\, p_1}{1 + a_1\, p + a_2\, p_2}$$

with detailed expressions for the constants a_1, a_2 and b_1.

The application of the virial adsorption isotherms to careful measurements made over a wide range of experimental conditions so that $\{h_a(\theta)/h_g(\theta)\}$ and β'_1 and β'_{12}, etc. can be evaluated should enable us to obtain important information concerning the state of molecules in the adsorbed phase.

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Defect Lattices and Catalytic Activity

A recent X-ray examination of the nickel-aluminium system[1] revealed the existence of the following phase-structures: Ni_3Al, Ni_2Al_3, and $NiAl_3$, in addition to the solid solutions of aluminium in nickel and nickel in aluminium. Ni_3Al is face-centred cubic and has a superlattice in which nickel atoms are at the centres of the cube faces while aluminium is at the cube corners. NiAl is body-centred cubic with aluminium at cube corners and nickel at cube centres. It was found that alloys with the NiAl type of phase structure were progressively more deficient in nickel atoms at cube centres, leaving vacant sites as the aluminium content of the alloy was increased. The absence of one third the number of nickel atoms changes the composition from NiAl to Ni_2Al_3 and produces a debasement from cubic symmetry to trigonal. The δ-phase structure Ni_2Al_3 can best be thought of as a deformed NiAl type. The empty sites in the structure are regularly distributed in planes perpendicular to the trigonal axis.

On treating the alloy Ni_2Al_3 with sodium hydroxide solution, one is able to dissolve out the aluminium. It has been found possible to change the composition of Ni_2Al_3, which corresponds to 59·2 per cent nickel (by wt.), to about 80 per cent nickel and yet *retain* the *trigonal* symmetry of the crystal. If the alloy were in its normal equilibrium state, it would of course consist of two phases, β and α′, which have the NiAl and Ni_3Al types of phase structure.

Further treatment with sodium hydroxide solution ultimately results in the collapse of the δ-structure. An alloy with 95 per cent nickel gave an X-ray spectrum showing the Ni_2Al_3 pattern along with that of two face-centred cubic structures. With less than about 0·5 per cent aluminium, only one face-centred cubic phase remains. It appears that the action of the caustic soda solution is to remove aluminium atoms from the lattice, leaving vacant sites, but that the structure ultimately collapses and tends to form the face-centred cubic structure of nickel.

Apparently, in the process, no intermediate body-centred cubic structure is formed. A further interesting point is that the X-ray spectra are reasonably sharp, indicating that most of the material consists of relatively large particles of the order of 1,000 A.

The research is being continued with a series of binary and ternary alloys of the Ni_2Al_3 (δ) type and also with γ-alloys, which can also be characterized as having a defect lattice formed from a CsCl-type of structure.

The structures described above bear an interesting relationship to the action of these metals as catalysts. Nickel catalysts prepared from nickel aluminium alloys (Raney nickel) are used extensively in industry for hydrogenation purposes. These defect lattices all possess a very large highly unsaturated surface (on account of the lattice defects), and electron transfer processes should be considerably enhanced. It has been demonstrated previously that simple electron transfer processes play an important part in the catalytic decomposition of hydrogen peroxide on metal surfaces[2]. It can also be shown that in hydrogenation, reaction with molecular hydrogen and in the Cannizzaro reaction of aldehydes, which are both strongly catalysed by this nickel catalyst, the essential elementary processes on the surface of the catalyst can be described as electron transfer reactions (that is, oxidation-reduction processes in a chemical sense).

A full account will be published elsewhere.

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Similarity and Dissimilarity

Classification is based upon perception of similarity. The following experiment, carried out with the help of about forty observers, in connexion with a course of lectures on scientific method, was designed to get information on the readiness with which similarities are noted.

Various objects were exposed in pairs to those taking part in the experiment. The typed instructions given to each observer were: "Two objects will be placed on the lecture bench and you are asked to compare them. Write down any points of comparison that occur to you, setting them down in the order in which they occur. Any points of comparison *whatever*, relating to the two objects, are asked for. Brief phrases in 'telegraphic English' will suffice." In order that the observers should be unprejudiced, care was taken not to mention either classification, similarity or dissimilarity. A time of 3 minutes was found to be convenient for the comparison of such pairs of objects as an orange and an apple, or an open pen-knife and a pair of scissors.

At the end of the experiments, the answers to three questions were included in each report: "(1) Have you ever taken part in a similar experiment? (2) Have you ever read of similar experiments? (3) By 'compare', did you understand that both similarities and differences were to be included?" The