

## Atomic Energy and Catalyst Efficiency.

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While examining the curve given by Biltz (*Z. Elektrochem.*, 1911, 17, 670) connecting the vibration frequency of the elements with their atomic weight, I observed that all the elements near the peaks of the curve are those commonly regarded as good catalysts. The height of the peaks diminishes with increasing atomic weight and hence it seemed possible that a function involving the product of atomic weight and frequency might be correlated with catalytic activity. Such a function is the energy of vibration of the atom  $4\pi^2 m \nu^2 r^2$ , where  $m$  is the atomic weight,  $\nu$  the vibration frequency and  $r$  the amplitude of vibration of the atoms at the melting point of the solid calculated from the atomic volume (*cf.* Lindemann, *Physikal. Z.*, 11, 609, 1910), and in view of the large interchange of energy which occurs during a catalytic reaction it might be expected that substances for which the vibrational energy is high would show high catalytic activity. I have calculated the value of this energy for the commoner elements using Biltz' values for  $\nu$  as re-

calculated by Lewis (*Physical Chemistry*, 1921, 3, 61). The results are:—

	$\nu \times 10^{-12}$	$m.\nu^2 r^2 \times 10^{-22}$		$\nu \times 10^{-12}$	$m.\nu^2 r^2 \times 10^{-22}$
Graphite	... 27.7	278	Barium	... 2.4	87
Diamond	... 31.7	273	Strontium	... 3.0	85
Osmium	... 5.1	207	Calcium	... 4.9	83
Tantalum	... 4.75	201	Arsenic	... 4.36	80
Iridium	... 4.9	195	Antimony	... 3.0	78
Molybdenum	... 6.3	185	Magnesium	... 7.2	73
Thorium	... 3.2	169	Aluminium	... 7.5	73
Titanium	... 8.4	165	Cerium	... 2.64	72
Platinum	... 4.36	162	Phosphorus	... 6.3	69
Vanadium	... 8.3	156	Cadmium	... 3.0	56
Palladium	... 5.74	153	Zinc	... 4.36	56
Nickel	... 8.2	146	Lead	... 1.84	48
Iron	... 8.3	142	Bismuth	... 1.6	41
Cobalt	... 8.2	140	Tin	... 2.24	39
Chromium	... 8.3	137	Selenium	... 2.7	37
Silicon	... 9.6	132	Sulphur	... 3.96	31
Manganese	... 7.5	117	Sodium	... 3.96	30
Gold	... 3.4	107	Iodine	... 1.6	28
Copper	... 6.7	105	Potassium	... 2.3	26
Silver	... 4.36	97	Bromine	... 1.7	20
			Mercury	... 1.25	19
			Chlorine	... 2.24	14

The first column includes practically all the elements usually used as catalysts and the second the feeble catalysts and poisons, so that it appears that the atomic energy is a factor of decided importance in catalysis.

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