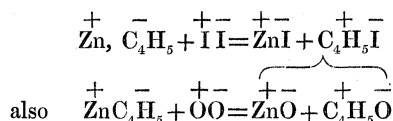
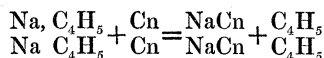


The ordinary reactions of zinc-ethyl may be looked upon as illustrating this proposition, and can be written so as to exhibit a double displacement.



Inspection will show in all these cases, that an electro-positive radical displaces a less electro-positive radical; and an electro-negative radical displaces a less electro-negative one.

In accordance with the theory would be the displacement in sodium-ethyl of the ethyl by mercury, or by copper, &c., platinum, &c.



Also a like displacement by arsenic or by nitrogen would be according to theory.

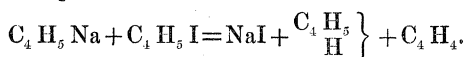
Pushing the hypothesis to its furthest limits, I should say that sodium-ethyl is only in *equilibrium* with bodies whose respective electrical sides lie either both of them *within*, or both of them *without* the space lying between the electro-positive sodium and the electro-negative ethyl.

XXIII. "Note on Sodium-ethyl and Potassium-ethyl." By  
EDWARD FRANKLAND, Ph.D., F.R.S. Received June 17,  
1858.

The recent interesting discovery of sodium-ethyl and potassium-ethyl by Mr. Wanklyn, led me to investigate the cause of the non-formation of these bodies by reactions analogous to those successfully used for the production of zinc-ethyl and similar organo-metallic compounds. In my earlier experiments upon the isolation of the organic radicals, I studied the action of potassium and sodium upon iodide of ethyl, and found that the latter compound was readily decomposed by either of the metals at a temperature of from 100° to 130° C. The separated ethyl was, however, transformed almost completely into hydride of ethyl and olefiant gas, whilst not a trace of potassium-ethyl or sodium-ethyl was produced. Mr. Wanklyn has

since repeated this experiment with the addition of ether, and has obtained the same result as regards the non-formation of an organo-metallic compound.

The temperature at which sodium decomposes iodide of ethyl is much lower than that at which sodium-ethyl is broken up, consequently no explanation of the phenomenon can be obtained from this source. In his observations on the formation of ethyl\*, Brodie mentions that iodide of ethyl is decomposed at 170° C. by zinc-ethyl; and it therefore occurred to me that sodium-ethyl, owing to its more powerful affinities, might effect the decomposition of iodide of ethyl at a lower temperature than that at which iodide of ethyl is decomposed by sodium; in which case the production of sodium-ethyl, by the action of sodium upon iodide of ethyl, would be an impossibility. Experiment completely confirmed this anticipation. A quantity of a strong solution of sodium-ethyl in zinc-ethyl was thrown up into a dry receiver filled with mercury, and an equal volume of pure iodide of ethyl added to it. Immediately on the mixture of the two liquids, a lively effervescence set in, a considerable quantity of gas collected in the receiver, and a white deposit of iodide of sodium rendered the liquid thick and turbid. The reaction was complete in two or three minutes without the application of heat. An analysis of the gas, previously freed from the vapours of iodide of ethyl and zinc-ethyl, showed it to consist of equal volumes of hydride of ethyl and olefiant gas, mixed only with a mere trace of ethyl. This reaction may therefore be thus expressed:—

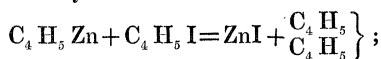


It is therefore evident that sodium-ethyl, and the remark no doubt applies also to potassium-ethyl, could not be obtained by the action of sodium upon iodide of ethyl, even if the decomposition of the latter could be effected at ordinary temperatures, since each particle of the organo-metallic compound being in contact with iodide of ethyl at the moment of its formation, would be instantly decomposed in the manner just described. That olefiant gas and hydride of ethyl, with mere traces only of ethyl, constitute the gaseous product of the decomposition of iodide of ethyl by sodium, is strong evidence that this formation and immediate decomposition of sodium-ethyl actually

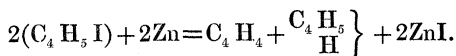
\* Journal of the Chemical Society, vol. iii. p. 405.

takes place. Sodium-ethyl thus stands in the same relation to iodide of ethyl as hydride of zinc does to hydriodic acid; and consequently all attempts to produce hydride of zinc by the action of the metal upon the hydrogen acids have failed. These considerations, taken in connexion with Mr. Wanklyn's mode of forming sodium-ethyl and potassium-ethyl, afford a clue to the nature of the reactions by which we shall probably eventually succeed in forming the hydrogen compounds of the highly positive metals. Although the hydrogen compounds of arsenic, antimony, phosphorus, and tellurium are by no means exact analogues of zinc-ethyl, it would nevertheless be interesting to ascertain the action of sodium upon these bodies, with a view to the formation of hydride of sodium.

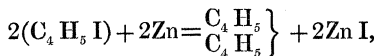
The nature of the gas evolved by the action of sodium-ethyl upon iodide of ethyl, has some interest in connexion with the formation of ethyl by the action of zinc upon iodide of ethyl. Brodie expressed, in the memoir above alluded to, an ingenious and highly probable hypothesis, that the true source of the ethyl is the decomposition of its iodide by zinc-ethyl, thus:—



and that the secondary products of the reaction (olefiant gas and hydride of ethyl) which always accompany the ethyl, result from the primary action of zinc upon iodide of ethyl, thus:—



The composition of the gases produced in the above reaction of sodium-ethyl upon iodide of ethyl seems, however, to indicate that the reverse of this hypothesis is true, and that the source of the ethyl is to be found in the primary action of zinc upon iodide of ethyl,—



whilst the secondary products are derived from the decomposition of iodide of ethyl by zinc-ethyl,—

