

FINAL TECHNICAL REPORT –DE-FG02-97ER41026

This document is a summary of the work done in the period from 1997 to 2014 as part of USDOE grant DE-FG02-97ER41026. Detailed reports describing this research have been submitted in the form of Annual Progress Reports and Renewal Proposals. The most complete report of the work carried out as part of this research project can be found in the ~100 papers published in the open refereed literature. These papers include

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In addition, 107 invited talks were delivered by the PI during the contract period.

These papers and the work they represent can be divided into certain broad categories. As an academic nuclear chemist, Loveland is a participant in the effort to train future nuclear chemists, an acknowledged national goal. Papers 5,8,9,13,17,28, 29, 30,31,32,36,38,40, 41,47, 62, 68, and 93 represent contributions to this effort. Most notably amongst these is Loveland's co-authorship with Seaborg and Morrissey of one of the leading nuclear chemistry textbooks.

Through collaboration with colleagues at the Lawrence Berkeley National Laboratory, Loveland has participated in a number of experiments to synthesize new heavy and super-heavy nuclei (papers 7,14,20,21,24,25,27, 45, 59, 70 and 98). This work led to the conformation of the synthesis of elements 110 and 112.

Loveland and his group have been pioneers in the use of radioactive beams to synthesize new heavy nuclei. (papers 1,2,3,12,26, 33, 34, 37, 39, 42, 43, 44, 49, 51, 52, 53, 63, 66, 71, 77, and 78.) The bottom line of this research is that new superheavy nuclei will not be made using radioactive beams (due to low beam intensities) but that opportunities to synthesize several new neutron-rich heavy do exist.

Loveland and his group have been involved in attempts to critically examine the reactions used for superheavy element synthesis and to point out areas where improvements of our understanding to these reactions are possible. (papers 16,18,54,55,56,60,64, 72,79,81,82,85,94,95,96, 97 and 99).

During the early years of this research project, Loveland and his group studied the mechanism(s) of heavy residue formation in intermediate energy nuclear collisions (papers 4,6,10,15,19,22,23,61, and 65) These measurements were made using radiochemical techniques which offered a unique way to study these low energy species. As an offshoot of this work and as a residue of earlier work, Loveland was involved in one study of relativistic nuclear collisions (paper 48).

Like all experimental groups, Loveland and colleagues contributed to certain technical developments (papers 11,35,58,67, 73,74,83,84,87-92). Fission was the subject of papers 46 and 86.

Loveland and colleagues made special efforts to study the fusion of the halo nucleus ^{11}Li with ^{208}Pb —where they found that contrary to some expectations, ^{11}Li did fuse, in part with ^{208}Pb , rather than breaking up in the collision. (papers 50, 57, 69, 75, 76, 80).

