MONOMOLECULAR LAYER RADIOACTIVE SOURCES OF ^{51}Cr

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The $CrCl_3$ aqueous solution and surface active substance - stearic acid system has been studied for obtaining monomolecular layer radioactive sources (MMRS) of ^{51}Cr by adsorption method.

It is concluded that the stability of stearic acid monomolecular layer (MML) depends upon its interaction degree with Cr ions from the $CrCl_3$ aqueous solution.

The stability of MML could be achieved by increasing the interaction degree through increasing Cr ion concentration, pH values over 6.5 for concentrations $<10^{-6}$M $CrCl_3$, and the interaction time. However, at low pH values the stability of stearic acid MML could be also achieved, but for Cr ions concentrations $>10^{-4}$M.

The optimum mechanical properties of the MML, being strongly dependent on the pH values, have been determined considering a family of $\pi - \sigma$ curves at different pH values. (π - surface pressure on the MML |dyn/cm|, σ - surface per molecule |Å /molecule|). The obtained results are: (1) Chromium stearate MML, having surface pressure higher than the critical (π_c), in the interval $4.5 < pH < 5.5$ are more brittle than those at pH = 6.5, while at pH > 6.5 the MMLs suffer plastic deformation. (2) Increasing pH value from 4.5 to 7.2 for 10^{-6}M $CrCl_3$ solutions the region of the liquid condensed phase ($\sigma_o - \sigma_T$) gets narrow, while $\Delta\pi/\Delta\sigma$ rises. For high reproducibility of the MML transfere from the solution to the solid substratum, the MML surface pressure has been choosen in the liquid condensed region near the point (σ_T, π_T) where phase change takes place.

The obtained MMRS radioactivity for the concentration range from 10^{-8}M to 10^{-6}M $CrCl_3$ is proportional to Cr ions concentration in $CrCl_3$solution itself and is given by $A_s = K \cdot C$ (A_s |dis/s/cm² MML|, $K = 1.1 \times 10^{11}$ |dis/s^{-1}cm^{-2}/mol l^{-1}|). For concentration > 10^{-6}M $CrCl_3$, at saturation of the MML, the radioactivity of the MML remains constant, i.e. A_s = const.

The chemical stability of the MMRS has been tested by examining the desorption rate of the Cr ions from it in an aqueous solution, 10^{-6}M and 10^{-4}M $CrCl_3$, respectively. ^{51}Cr desorbed activity from the MMRS varied from 1.7% for aqueous solution, 2.7% for 10^{-6}M $CrCl_3$, to 5% of the total MMRS radioactivity for 10^{-4}M $CrCl_3$ after 24^h interaction time.[1,2]

Satisfactory homogeneity of ^{51}Cr MMRS has been found applying an autoradiographical method.

From the linear relation between the counting rate of K-Auger electrons of V and the number of the chromium stearate MMLs it has been concluded that selfabsorption of the V K-Auger electrons is negligible up to 6 MMLs.[2]

The K-Auger spectrum from ^{51}Cr MMRS obtained by proportional counter having He + CH_4 (9 : 1) filing gas mixture at 1 atm. has been analysed and the resolution has been found to be 25%.

REFERENCES

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2) Lj. Dobrilović and M. Simović, *Nuclear Instruments and Methods* 112 (1973) 359 - 366