

# Corrosion of triuranium disilicide in vapor under simulated PWR condition

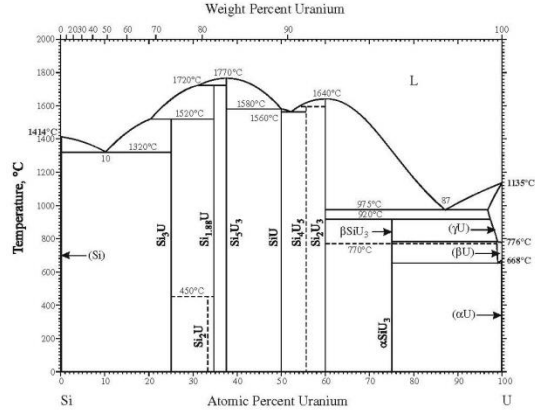
Technical Meeting on Compatibility Between Coolants and Materials for Fusion  
Facilities and Advanced Fission Reactors

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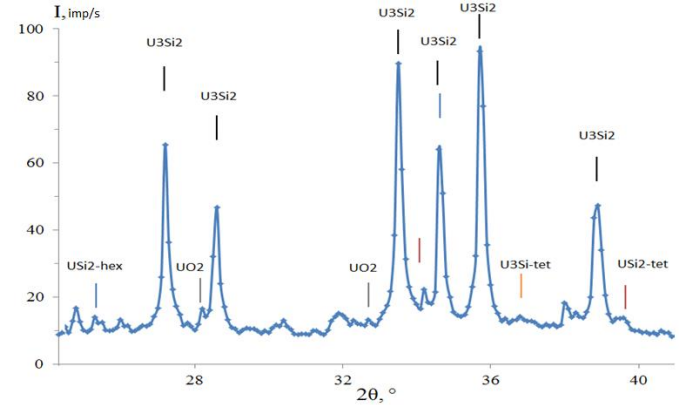
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Institute), Moscow, Russia, 2023*

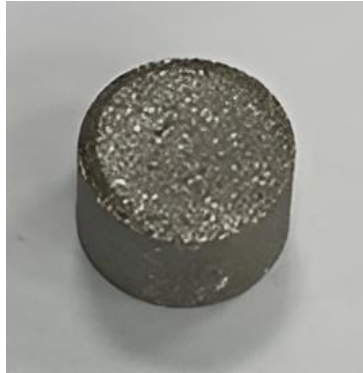
# Source materials



U-Si phase diagram



X-ray diffraction pattern of samples



$U_3Si_2$  sample

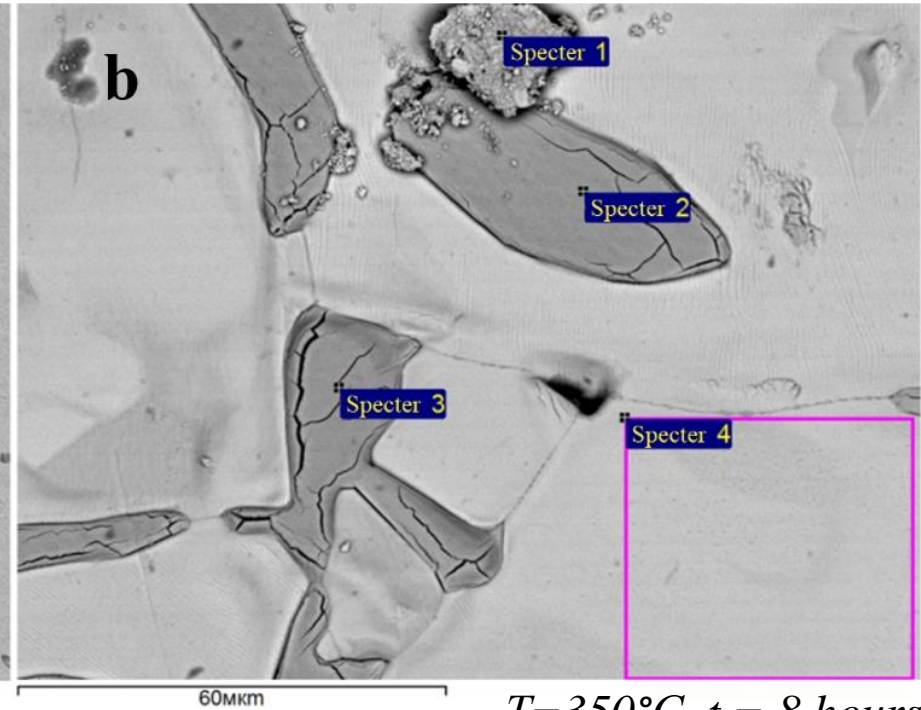
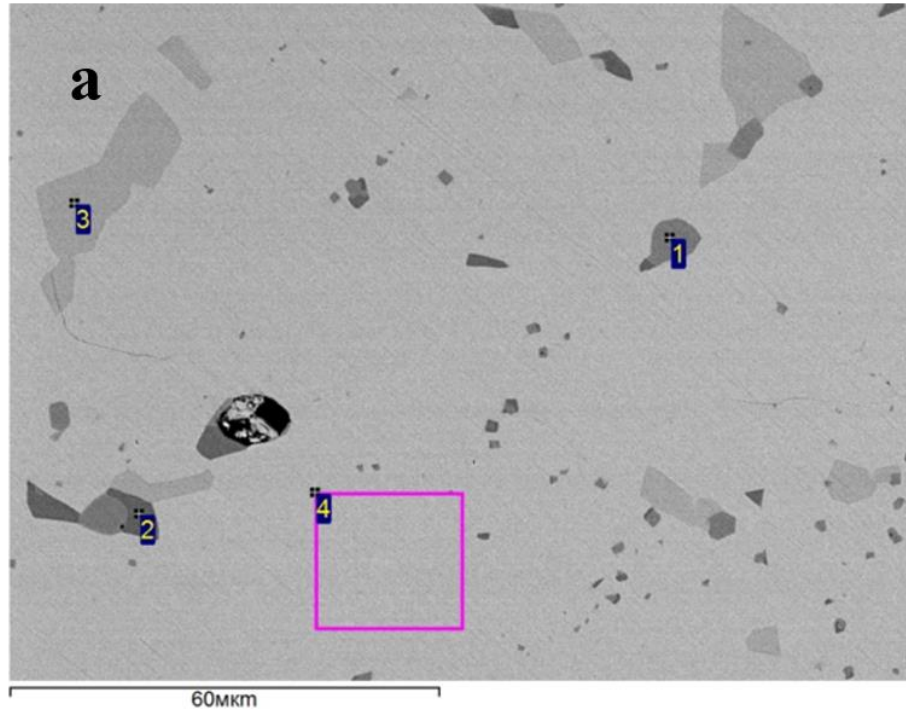


Zirconium tube



Autoclave

## Comparison of the structure before and after corrosion



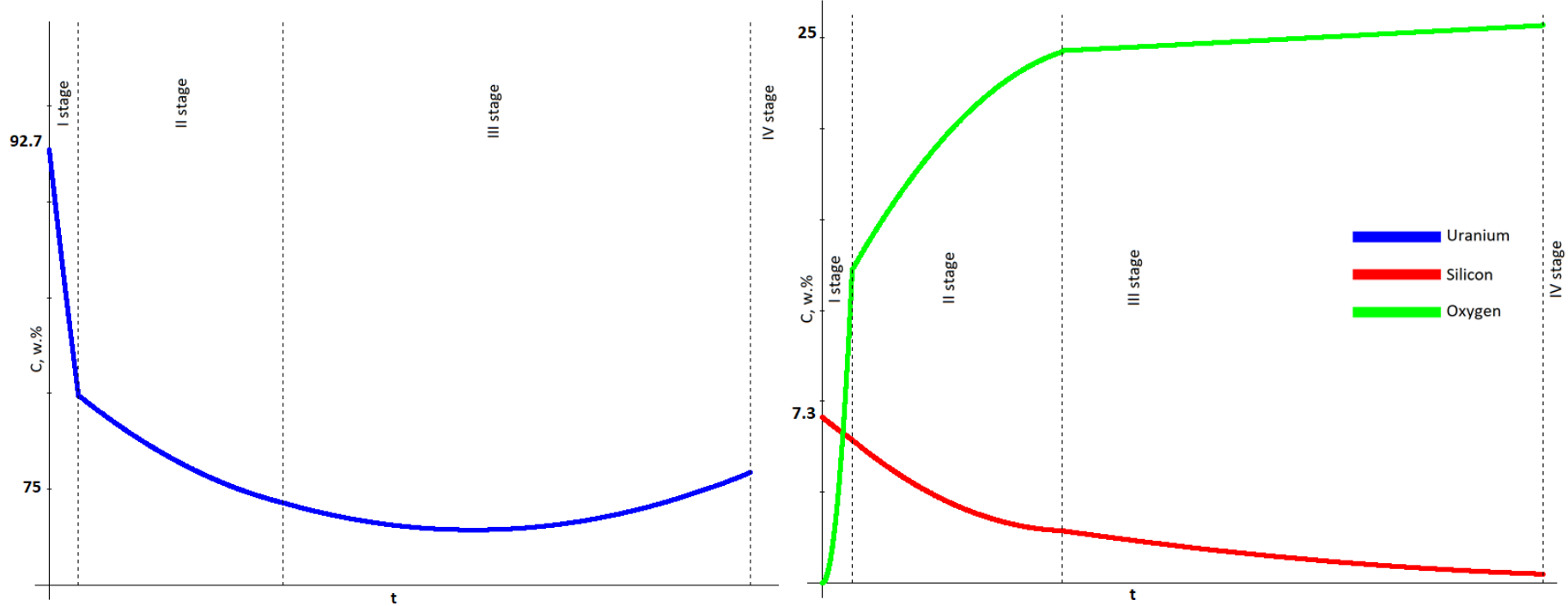
*T=350°C, t = 8 hours*

Specter	O, w.%	Si, w.%	U, w.%	Specter	O, w.%	Si, w.%	U, w.%
1(a)	4,0	7,6	88,9	1(b)	25,2	4,2	70,6
2(a)	3,7	7,5	88,8	2(b)	25,9	3,9	70,2
3(a)	4,0	8,2	87,8	3(b)	24,9	3,8	71,3
4(a)	3,5	7,2	89,3	4(b)	21,3	4,2	74,5

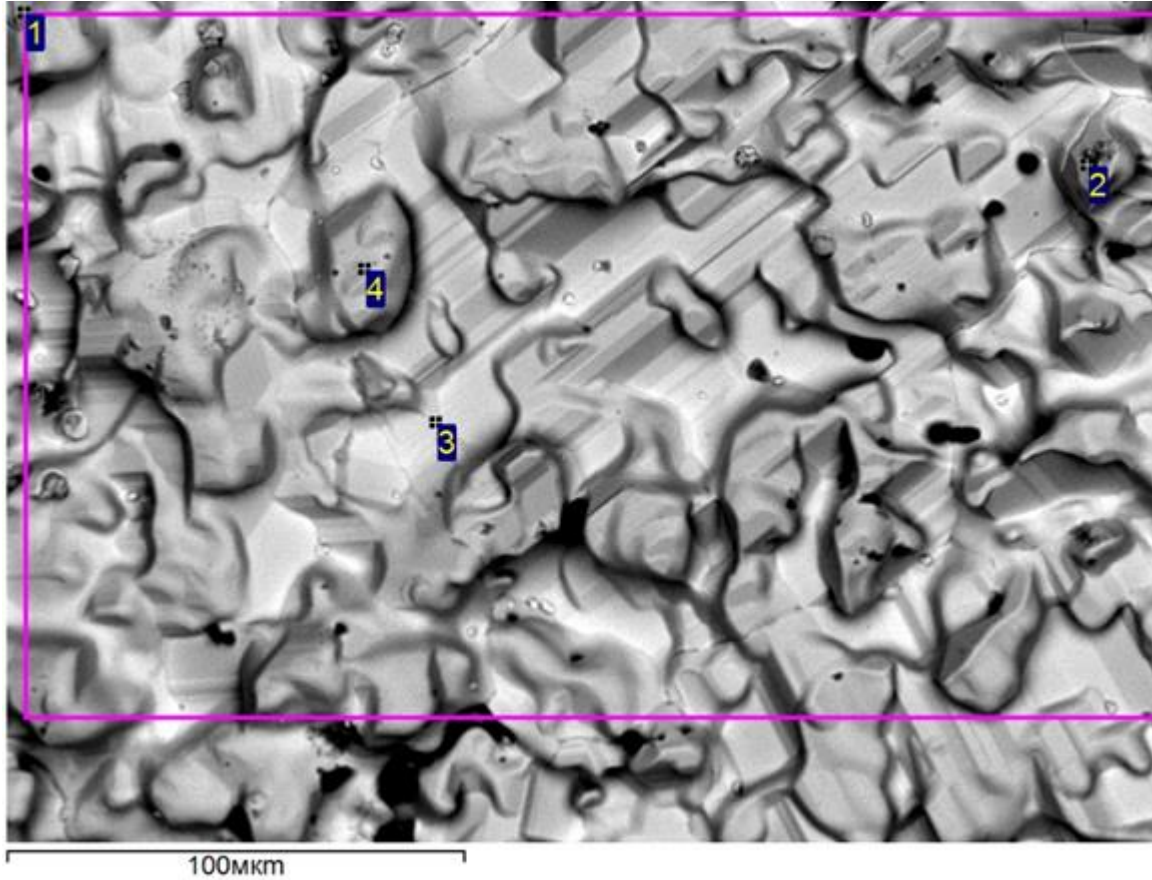
## Demonstration of the corrosion process for $U_3Si_2$



# Change in the concentration of the main elements



## I stage

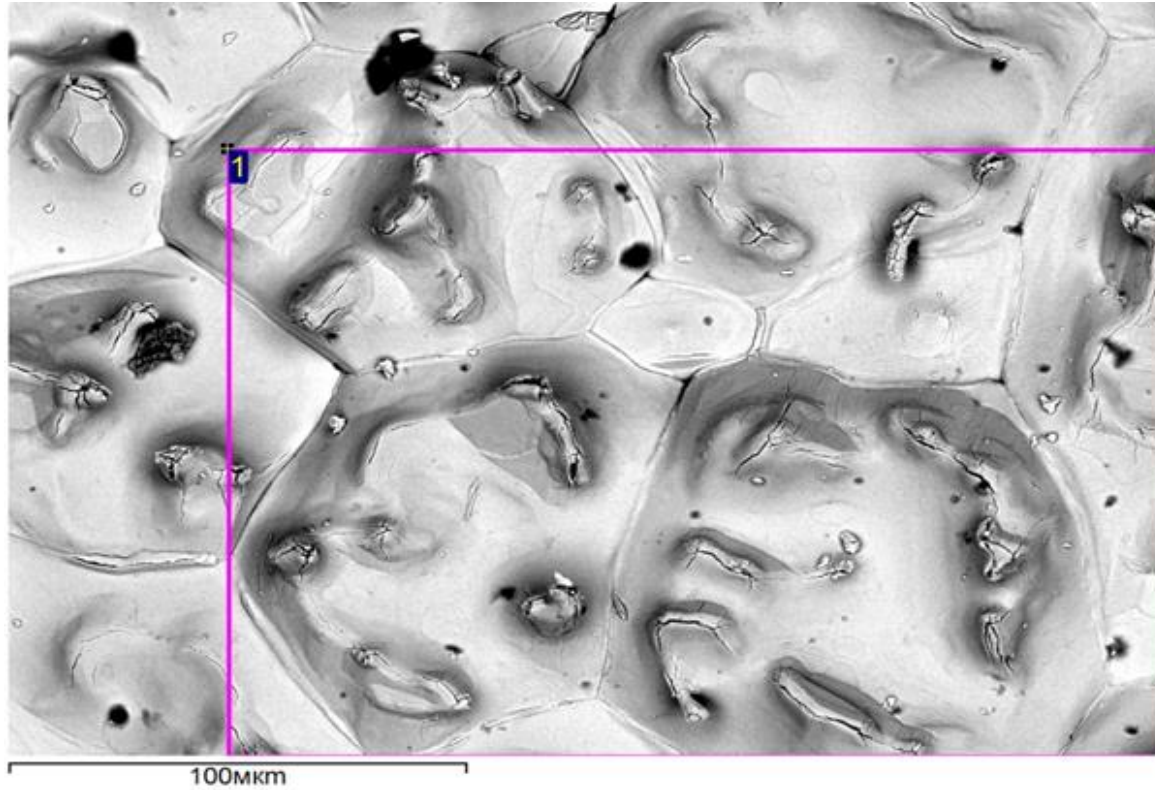


$T=450^{\circ}\text{C}$ ,  $t = 10 \text{ min}$



Specter	O, w. %	Si, w. %	U, w. %
1	13,8	6,4	79,8
2	19,9	6,8	73,3
3	12,9	5,4	81,7
4	12,7	7,2	80,1

## II stage



$T=350^{\circ}\text{C}$ ,  $t = 6 \text{ hours}$



Specter	O, w.%	Si, w.%	U, w.%
1	25,2	2,2	79,8

### III stage



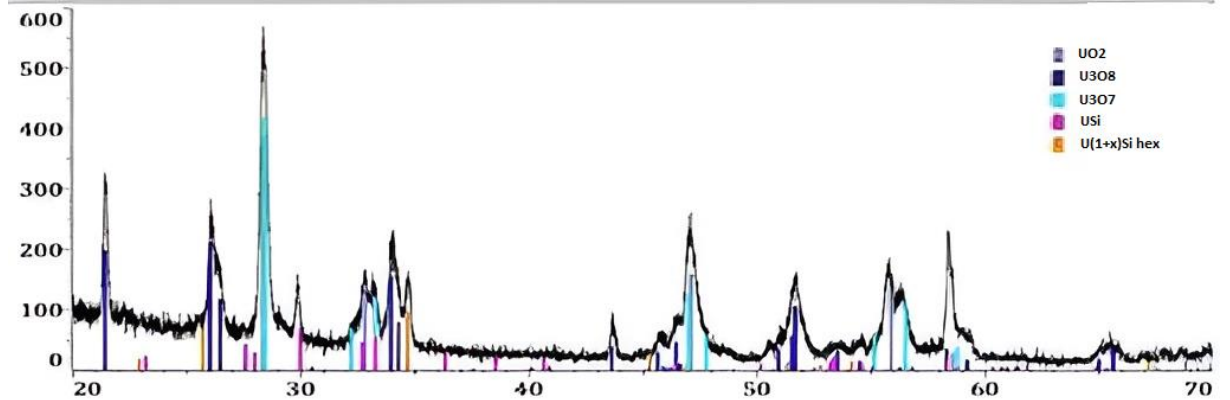
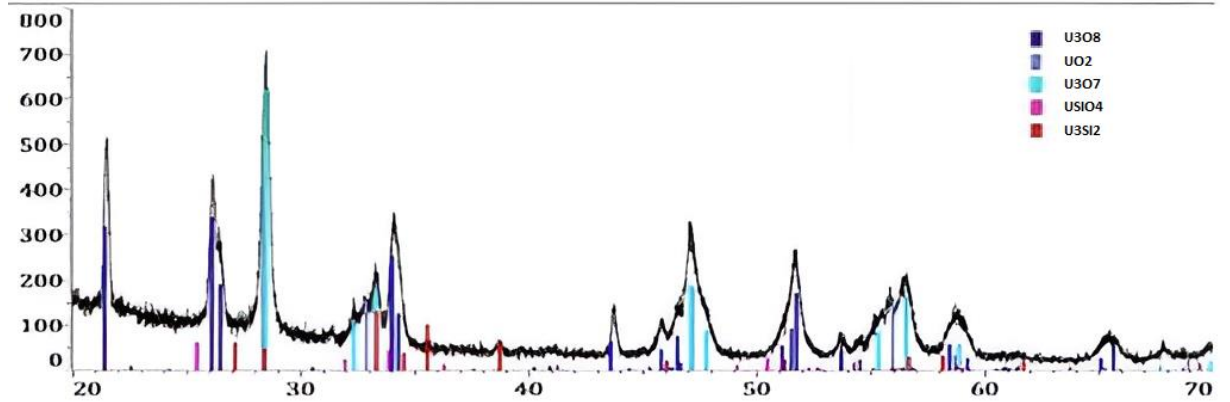
$T=400^{\circ}\text{C}$ ,  $t = 1 \text{ hours}$



Specter	O, w. %	Si, w. %	U, w. %
1	23,7	0,4	75,9



# IV stage



# Conclusion

- At a temperature of 350°C, triuranium disilicide samples retain structural stability and shape up to 24 hours of exposure.
- Oxidation of triuranium disilicide occurs with the formation of a silicon dioxide thin film at an early stage, which protects the material from further oxidation.
- When the temperature increases to 400°C or sufficient exposure time, the film is destroyed and replaced by a film of uranium oxides.
- At a certain point in time, the surface contains practically no silicon. The oxygen content remains almost unchanged; the uranium content increases due to a decrease in the proportion of silicon.
- Ultimately, the triuranium disilicide is fragmented and ground into a powder consisting primarily of uranium oxides.