

## Expenditure of Microscope Units for Replacement of Optical Lens in Hotcell 107

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### Abstract / Introduction

Optical microscopes placed at hotcell 107 from the Radiometallurgical Installation (RMI) are one of the main tools for post irradiation tests that are used to obtain structural data (metallography or optical microscopy) from irradiated material from nuclear fuel or its supporting components. Leitz MM 5 RT optical microscope (Figure-1) has been designed / modified so that it can be placed in hotcell and operated safely. The optical microscope unit is in a hotcell (hot box), while all control equipment, cameras, projection screens and illumination lights are placed outside the 07 hotcell test. Between optical microscopes and other equipment are separated by gamma radiation shields (see Figure 2). ) The radiation shield becomes one part intact with optical microscope equipment. In the condition installed in the hotcell all equipment from the optical microscope including the gammar radiation shield sits on the chassis (Figure-2).

In the present condition, the optical microscope in hot test 07 needs to be modified, namely the replacement of the objective lens. The objective lens to be installed has a resolution that is far better than the previous lens. This modification aims to improve the performance of optical microscopes at HotCell 107.

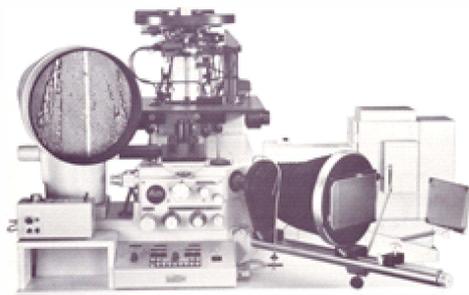


Figure 1 Leitz MM RT microscope

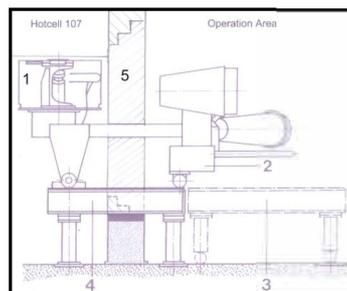


Figure 2 Optical Microscope Scheme in Hotcell 107

1. Microscope Unit
2. Control Unit
3. Chassis in Operation Area
4. Chassis in Hotcell
5. Radiation Shielding

### Result and Discussion

The 07 test hotcell optical microscope was successfully removed from the 07 hotcell test into the operation area without experiencing significant obstacles and safety aspects from the dangers of radiation and contamination maintained.

Several preparatory and consideration steps must be taken for the withdrawal of the optical microscope along with its radiation shielding from hotcell 107 to the operation area. This must be done carefully and carefully because it has never been done by RMI staff, and there is a risk of contamination and so that the level of precision of the equipment is maintained (optical lens and driving mechanism). This can be done by a combination of related document studies including technical drawings and discussions with personnel who have participated in the initial installation process in 1991.

Under normal circumstances, the upper surface of the steel box lens of the microscope unit presses the work surface of the optical microscope inside the hotcell. This pressure is adjusted by locking the position of the rotary shaft in the operation area in the maximum position up. This is intended to keep the air from the hotcell and microscope unit not connected to the space outside the microscope unit. Or in other words to prevent contamination on the outer surface of steel boxes, chassis in hotcell, shielding on the chassis and the room. In order for the microscope unit to be pulled out, the pressing process must be freed by lowering the position of the closing steel box. This can be done by removing the turning shaft and rotating it in a counterclockwise direction. This has never been done before, so the reduction process is also observed from the hotcell to ensure the position of the microscope unit can already be pulled out.

The back and forth motion shaft is rotated for the direction of motion to the operation area until the microscope unit along with the radiation shield is in the operation area. The turning shaft is a stick (about 150 cm long), with one "T" shaped end for manual rotary motion, and one suitable locking eye welded at one other end, to rotate the wheel drive mechanism. The rotary motion is counterclockwise to pull the microscope unit along with the radiation shield out from the hotcell to the operation area (on the chassis rail line) and clockwise to move into the hotcell.

During the process of moving out of the hotcell, monitoring of radiation exposure and contamination is also carried out. The results of monitoring showed that the level of gamma radiation exposure was very small (not exceeding  $<10 \mu\text{Sv} / \text{hour}$  for IRM zone II) so that the withdrawal process could continue. After that, contamination was monitored around the microscope unit after the steel box was removed, the results showed smaller than  $37 \text{ Bq} / \text{cm}^2$  ( $\beta$ ) while the limit for zone II (operating area at IRM) was free of contamination. Then the microscope unit was pushed back into the hotcell while waiting for the isolation room in the form of a green house to be made. After the isolation room is made, the microscope unit is pulled out again, and continued with the decontamination process on the microscope unit. During the decontamination process, implementing personnel are equipped with adequate personal protective equipment and are supervised by a Radiation Protection Officer. Furthermore, the Modification work from the microscope unit can be done, namely the replacement of the objective lens.

## Conclusion

The objective lens replacement of the optical microscope in HC 107 has been completed and can function well for the microstructural analysis of  $\text{U}_3\text{Si}_2 / \text{Al PEB}$  after irradiation with 500x magnification. In addition, one SOP document has been replaced by the 107 hotcell optical microscope lens.

## References

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2. ANONIM, DOKUMEN GCNF, OPTICAL MICROSCOPY ZG-UJI 07, MECHANICAL PARTS III/83 S/D III/88, 1991