



## SPECIFICATION

### Optically Stimulated Luminescence (OSL) Reader

#### 1. Scope

This specification describes the requirements for an automated Optically Stimulated Luminescence (OSL) reader (hereinafter referred to as 'the System'). The System will be used at the University of Jordan / Yarmouk University (hereinafter referred to as 'the End-User') to date archaeological and geological mineral material using luminescence signals. A luminescence reader is required to estimate the dose by measuring luminescence signals from quartz and feldspar extracted from the sample.

The System shall include a reference radiation source, which is usually  $^{90}\text{Y}/^{90}\text{Sr}$  beta source, control, operation and analysis software, and automated filter changer.

#### 2. Definitions, Acronyms, and Abbreviations

The following definitions, acronyms, and abbreviations shall apply throughout this Specification unless defined otherwise hereinafter:

- TL/OSL - Thermoluminescence and optical simulated luminescence

#### 3. Requirements

##### 3.1. Functional and Performance Requirements

The System shall meet the following functional and performance requirements:

- 3.1.1. The System shall include an automated TL/OSL system with a measuring chamber and an exchangeable sample carousel;
- 3.1.2. The System shall be upgradable in the future, with attachments such as a sample camera, a device for X-ray fluorescence analysis of quartz and feldspar, facilities for the measurement of infra-red photo luminescence;
- 3.1.3. The System shall be compatible to fit with a laser-based single-grain system for the measurement of luminescence from individual sand-sized grains of quartz and feldspar;
- 3.1.4. The System shall be capable of making accurate fading measurements on feldspar. This requires that grains are completely retained by the sample holder without loss, even if an adhesive (e.g. silicone oil) is not used. The controlling software shall also allow accurate tracking of the time between irradiation and measurement;
- 3.1.5. The System shall allow ease of cleaning, the reader shall have a fully accessible sample chamber with an exchangeable sample wheel(s); and
- 3.1.6. The System shall have a proven track record and shall be referred to in scientific papers.



### 3.2. Technical Requirements

The System shall meet the following technical requirements:

- 3.2.1. The System shall be equipped with a sample changer with a capacity of at least 45 samples, each consisting of ~20 mg of mineral material mounted on stainless steel discs or cups;
- 3.2.2. The System shall be equipped with photomultiplier tube operated in photon counting mode together with appropriate detection filtration for measuring the natural luminescence from quartz and feldspar with absorbed doses following natural radiation exposure of a few years or more. The dark background count rate in the presence of the beta source shall be sufficiently low to permit these measurements;
- 3.2.3. The System shall be equipped with Stimulation light sources:
  - (i) emitting at 470 nm, and delivering  $>70 \text{ mW/cm}^2$  at the sample position, and
  - (ii) emitting at ~850 nm, and delivering  $>150 \text{ mW/cm}^2$  at the sample position;
- 3.2.4. The System shall be equipped with a heating system, capable of heating the sample up to  $700^\circ\text{C}$ , at constant heating rates between  $0.01$  and  $10^\circ\text{C/s}$ ;
- 3.2.5. The System shall be equipped with beta source capable of delivering a dose rate of  $>0.1 \text{ Gy/s}$  to a quartz or feldspar sample on stainless steel discs;
- 3.2.6. The controller shall be able to show the current system status, the command which is currently being executed and reports failure messages such as thermal failure and the receipt of invalid commands;
- 3.2.7. The System's accessories shall include: a coarse grain calibration quartz, a fine grain calibration quartz, 1 set of spray masks, 200 stainless steel sample cups ( $\varnothing=11.7 \text{ mm}$ ); 200 stainless steel sample discs ( $\varnothing=9.7 \text{ mm}$ ), 200 aluminium sample discs ( $\varnothing=9.7 \text{ mm}$ ), 350 aluminium sample cups ( $\varnothing=11.7 \text{ mm}$ ); and
- 3.2.8. The System shall be provided with Windows-based control software (in English) capable of running complex sequences of  $>1000$  steps on each sample position and be able to run unattended throughout these sequences. The latter shall include fading measurements running over many days, low and high dose single aliquot regenerative dose measurements, linearly modulated optical stimulation measurements, and elevated temperature optical stimulation.

### 4. Marking

The System shall have labels indicating the radiation hazards associated with the instrument as required by international regulations. Any text on safety labels shall be written in English.



## 5. Packing

The System, for the shipment by air to the End-User, shall be packed in accordance with international standards that are applicable for the shipment by air of this kind of equipment. This is especially applicable to any radiation source(s).

## 6. Quality Requirements

- 6.1. The System shall be manufactured, shipped and installed in accordance with the Contractor's ISO quality assurance system or an equivalent quality assurance system.
- 6.2. The Contractor shall document the compliance with this quality assurance system.

## 7. Testing and Acceptance

- 7.1. The System, prior to shipment, shall be tested for conformance of the System with manufacturer's performance specifications and the minimum requirements specified herein.
- 7.2. The System, after installation, shall be tested by the Contractor together with the End-User to demonstrate that the performance meets the manufacturer's performance specifications and the minimum requirements specified herein as determined by the IAEA and the End-User.
- 7.3. The results of the testing of the System shall be documented by the Contractor in an acceptance protocol that shall be signed by the End-User.

## 8. Installation and Training

- 8.1. The Contractor shall install the System at Yarmouk University, Irbid, Jordan.
- 8.2. The Contractor shall provide a minimum of one (1) day training for up to three (3) staff of the End-User in the operation and maintenance of the System at the End-User's location immediately after the installation of the System.

## 9. Deliverable Data Items

The Contractor shall provide two (2) complete sets of operation and servicing manuals and technical drawings in the English language.