

DIN EN 17488:2021-09 (E)

Conservation of cultural heritage - Procedure for the analytical evaluation to select cleaning methods for porous inorganic materials used in cultural heritage

| Contents | | Page |
|-------------------------|--|-------------|
| European foreword | | 4 |
| Introduction | | 5 |
| 1 | Scope | 7 |
| 2 | Normative references | 7 |
| 3 | Terms and definitions | 8 |
| 4 | Abbreviations | 9 |
| 5 | General procedure (Part A) | 9 |
| 5.1 | Overview | 9 |
| 5.2 | Identification of substrate and characterization of unwanted materials | 10 |
| 5.3 | Selection of suitable cleaning methods to be tested | 11 |
| 5.4 | Localization, delimitation and numbering of the cleaning trial areas | 11 |
| 5.5 | Design of the evaluation procedure and definition of a referenced cleaned area | 12 |
| 6 | On site surface investigations | 15 |
| 6.1 | Optical observation | 15 |
| 6.1.1 | Portable digital microscope | 15 |
| 6.1.2 | Raking light | 15 |
| 6.1.3 | Portable digital stereo microscope | 15 |
| 6.1.4 | Fluorescence induced by UV radiation | 15 |
| 6.2 | Chemical/physical analysis | 16 |
| 6.2.1 | Measurement of colour | 16 |
| 6.2.2 | Elemental analysis by portable XRF | 16 |
| 6.2.3 | Molecular analysis by portable FTIR | 16 |
| 6.2.4 | Surface ion analysis | 16 |
| 6.3 | Water absorption assessment | 17 |
| 6.3.1 | General | 17 |
| 6.3.2 | Determination of water absorption by pipe method (in situ) | 17 |
| 6.3.3 | Determination of water absorption by contact sponge method (in situ) | 17 |
| 6.3.4 | Water drop test (in situ) | 17 |
| 7 | Laboratory analysis on samples taken from trial areas | 18 |
| 7.1 | General | 18 |
| 7.2 | Sampling | 18 |
| 7.3 | Chemical/physical analysis | 19 |
| 7.3.1 | Examinations of fragments surfaces by TLOM, RLOM, SEM/ESEM and EDS microanalysis | 19 |
| 7.3.2 | Examinations of thin and polished and cross section by TLOM, RLOM, SEM/ESEM and EDS microanalysis | 20 |
| 7.3.3 | Vibrational spectroscopy (FTIR, micro-FTIR and Raman) | 20 |
| 7.4 | Surface morphology analysis | 20 |
| 7.4.1 | Measurement of roughness (see ISO 25178) | 20 |
| 7.5 | Wet chemical analysis (on aqueous extract) in the case of chemical cleaning | 21 |
| 7.5.1 | Extraction procedure | 21 |
| 7.5.2 | Analysis on aqueous extract | 23 |

| | | |
|-------|--|----|
| 8 | Overall evaluation of results obtained | 23 |
| 9 | Analytical procedure for testing methods under development on specimens of analogous material (Part B) | 24 |
| 9.1 | General procedure | 24 |
| 9.2 | Preparation of test specimens | 26 |
| 9.2.1 | Number and dimensions of test specimens | 26 |
| 9.2.2 | Pre-conditioning of test specimens | 27 |
| 9.3 | Evaluation process of the cleaning method(s) under test | 27 |
| 9.4 | Test analysis on specimens before and after the application of cleaning methods | 27 |
| 9.4.1 | General | 27 |
| 9.4.2 | Determination of water absorption by capillarity | 27 |
| 9.4.3 | Colour measurement of surfaces | 28 |
| 9.4.4 | Observation of the surfaces by the stereo microscope | 28 |
| 9.4.5 | Determination of mass variation | 28 |
| 9.4.6 | Thin and polished cross sections analysis by TLOM, RLOM, SEM/ESEM-EDS | 28 |
| 9.4.7 | Thin and polished cross sections analysis by TLOM, RLOM, SEM/ESEM-EDS on fragments of surfaces | 29 |
| 9.4.8 | Cleaning application | 29 |
| 9.5 | Analysis of aqueous extract for chemical cleaning | 30 |
| 9.6 | Test report | 30 |
| 9.6.1 | General information | 30 |
| 9.6.2 | Results of measurements on specimens | 30 |
| | Annex A (normative) Examples of trial applications | 33 |
| | Annex B (informative) Test carried out, findings, inference | 38 |
| | Annex C (informative) Specifications to be reported for different cleaning methods (see EN 17138:2018) | 48 |
| | Bibliography | 52 |