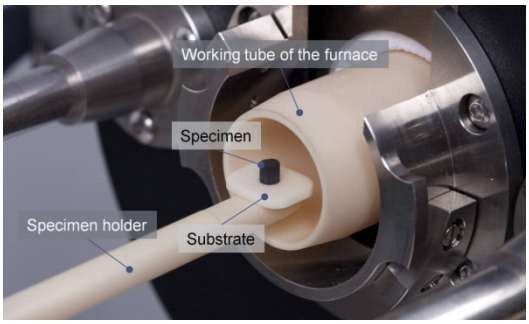
» Heating Microscopes EM201 & EM301

Alumina (Al_2O_3) Substrates

1 Introduction

In this information sheet you will learn which substrates are commonly used in a **Hesse Instruments** heating microscope, how the different substrates differ from one another and which influence they have on the results of a heating microscope measurement.

» Basic Information



The plate on which the specimen is placed during a heating microscope measurements is called substrate. It is placed on the specimen holder, which is moved into the furnace of the heating microscope.

The substrate protects the specimen holder and measuring chamber against contamination caused by the melting specimen. Furthermore its upper front edge forms the base line for the automatic image analysis.

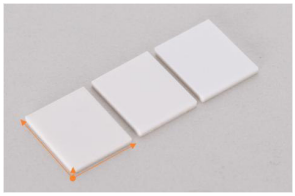
The material of a substrate has a direct influence on the result of a heating microscope measurement, because every substrate material is wetted to a different degree by the deforming or melting specimen.

▲ You will find further information about the wettability of substrates made of various materials by different sample materials in our application report **Influence of the Substrate Material on Results of Hesse Instruments' Heating Microscope EM301**.

The underlying standards for the determination of the fusibility of ashes, demand the use of substrates made of platinum. However, in order to limit costs and for reasons of practicality, availability and high chemical resistance substrates made of aluminium oxide (Al_2O_3) have become established in the past and are almost exclusively used for heating microscope measurements.

» Features and benifits of Hesse Instruments' substrates

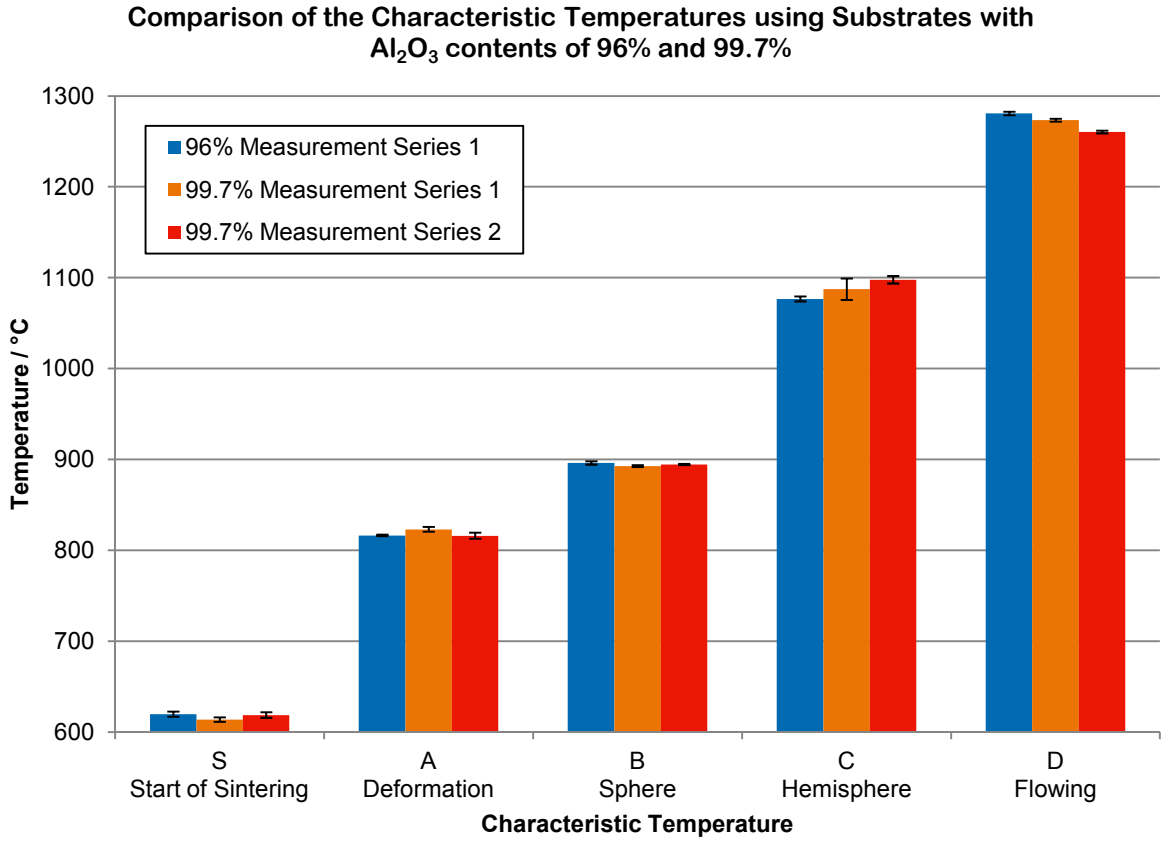
Two different qualities of substrates are offered by **Hesse Instruments** as a standard product:

	EZ-A121/997	**EZ-A101/96**
		
Composition	99.7 % Al_2O_3	96 % Al_2O_3
Length x width x height	12 mm x 10 mm x 1.5 mm	12 mm x 10 mm x 1.0 mm
Production process	Die pressed Surface "as fired“, planar	Tape casted Limited performance on one side

	EZ-A121/997	EZ-A101/96
Maximum temperatures	Temperatures up to ca. 1700 °C	Temperatures up to ca. 1600 °C
Characteristics	Provided that the specimen does not react with alumina: … Chemically resistant to corrosive and aggressive melts … Protection of the specimen holder due to a high barrier property of the 1.5 mm thick substrate	Provided that the specimen does not react with Alumina: … Chemically resistant to most standard glazes and enamels or oxide ceramics
General application	Applicability in the high temperature range of about 1700 °C, depending on furnace atmosphere and specimen composition.	Applicability in the high temperature range of about 1600 °C, depending on furnace atmosphere and specimen composition.
Recommended application	Measurement of ashes: coal ashes, ashes of solid recovered fuels, waste incineration, or any solid bio fuel; measurement of foundry products (iron or non-ferrous)	Measurement of glass, glazes, vitreous enamels and any ceramic material
Benefit	**Optimal level of safety**	**Cost-saving**

» Influence of Hesse Instruments' substrates on the measurement result

In order to determine the influence of the material of **Hesse Instruments**' substrates on the result of a heating microscope measurement, two measurement series were carried out with substrates made of 99.7 % Al_2O_3 and one measurement series with substrates made of 96.0 % Al_2O_3. The influence of the material is illustrated below in form of a bar diagram and two tables.



Evaluation of the individual measurements

Name of the measurement	Purity of the substrates	S Start of Sintering	A Deformation	B Sphere	C Hemisphere	D Flowing
110606_1	96	623	815	893	1074	1283
110606_3	96	623	816	895	1073	1283
110607_2	96	613	818	900	1083	1276
Average96 / °C		*620*	*816*	*896*	*1077*	*1281*
Standard deviation96 / °C		*6*	*2*	*4*	*6*	*4*
Standard deviation96 / %		*0,9*	*0,2*	*0,4*	*0,5*	*0,3*
110601_3	99,7	618	826	894	1063	1272
110606_2	99,7	615	826	890	1110	1277
110607_1	99,7	608	817	894	1089	1271
Average99 / °C		*614*	*823*	*893*	*1087*	*1273*
Standard deviation99 / °C		*5*	*5*	*2*	*24*	*3*
Standard deviation99 / %		*0,8*	*0,6*	*0,3*	*2,2*	*0,3*
110614_1	99,7	612	810	895	1090	1257
110616_1	99,7	624	815	893	1106	1261
110616_3	99,7	620	823	895	1097	1263
Average99 / °C		*619*	*816*	*894*	*1098*	*1260*
Standard deviation99 / °C		*6*	*7*	*1*	*8*	*3*
Standard deviation99 / %		*1,0*	*0,8*	*0,1*	*0,7*	*0,2*

Evaluation of all measurements

	S Start of Sintering	A Deformation	B Sphere	C Hemisphere	D Flowing
Average of all measurements / °C	617	818	894	1087	1271
Total standard deviation / °C	3	4	2	11	10
Total standard deviation / %	0,5	0,5	0,2	1,0	0,8

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