



MATERIAL REPORT
TITANIUM GRADE 5

RD/RM/2003

INTRODUCTION

The goal of this report is a short summary of Titanium Grade 5 atomization status for marketing purposes. There were multiple tests performed on Titanium Grade 5. The atomized material was in the form of a $\varnothing 1,6$ mm wire.

For each test, a microscopic analysis of the distribution, circularity, oxygen level, chemical composition, and flowability test was performed.

This report presents an overview of the findings from these tests.

AVERAGE TEST RESULTS

Table 1 Basic average values

	Diameter [μm]	Circularity
Average	55,94	1,00
Standard deviation	12,42	0,03
Max	123,21	1,00
Min	27,82	0,75

Figure 1 Photo of the material x100

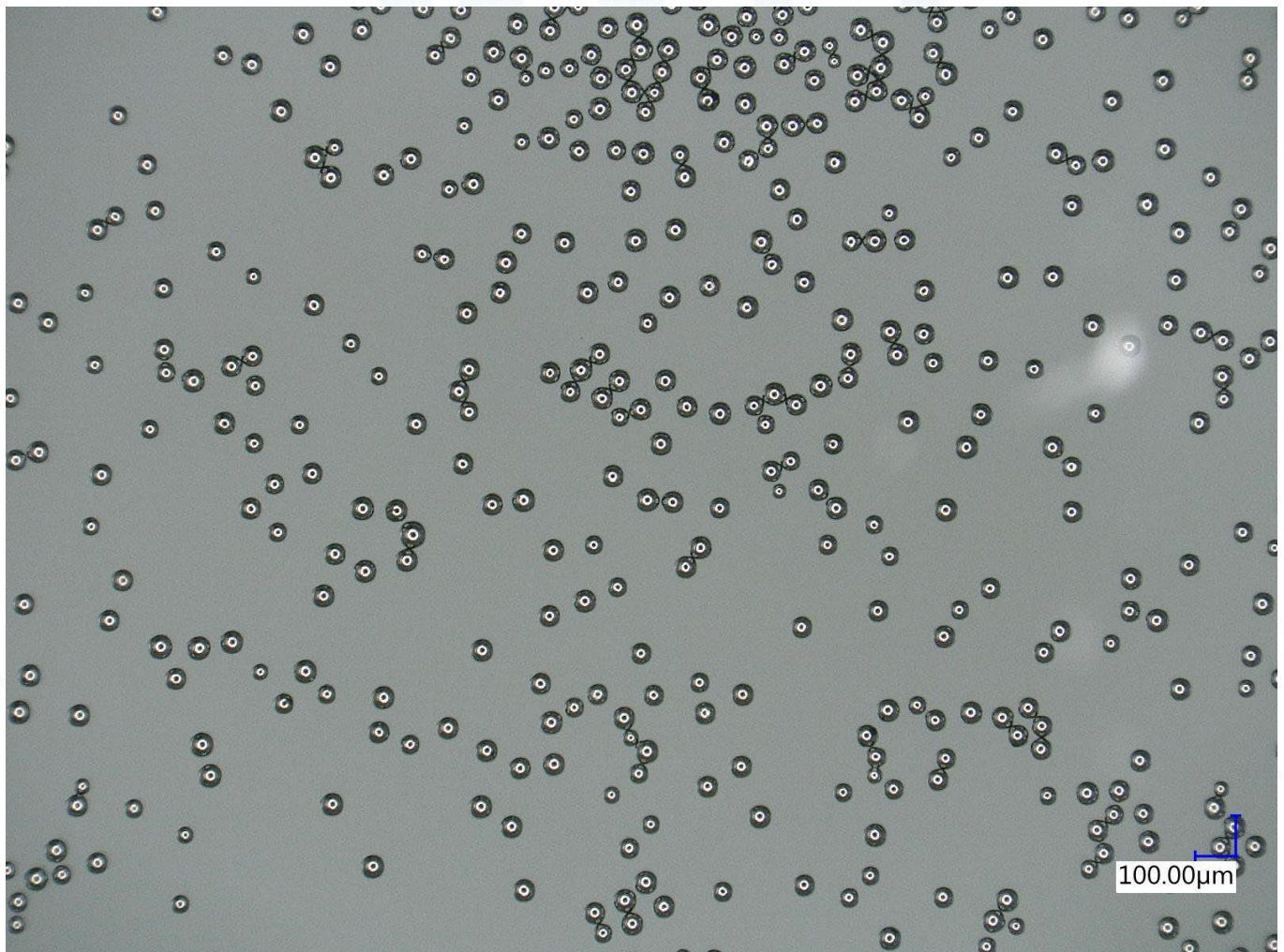


Figure 2 Histogram of the particle size distribution

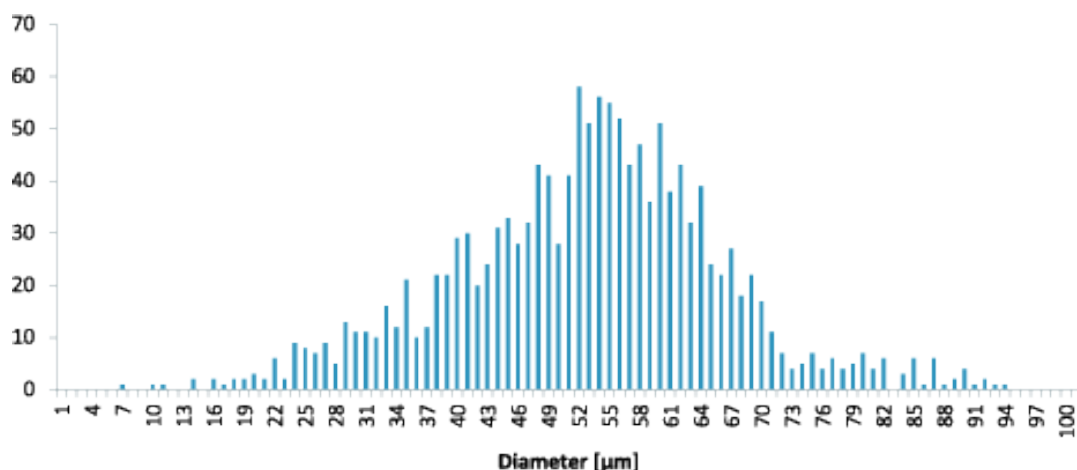


Table 2 Particles size distribution D10, D50, D90

D10	37,24	D50	48,87	D90	71,54
-----	-------	-----	-------	-----	-------

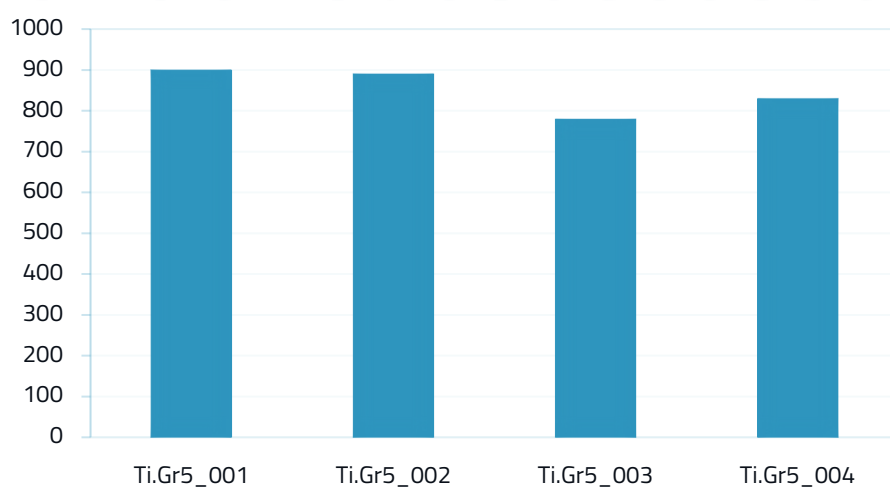
OXYGEN LEVEL

Oxygen levels have been tested in a certified laboratory. The results are shown below.

Table 3 Oxygen level in the samples

Sample	Test results [%]	U _B	Test methods
Ti.Gr5_001	0.090	0.002	LECO methodology
Ti.Gr5_002	0.089	0.002	
Ti.Gr5_003	0.078	0.002	
Ti.Gr5_004	0.083	0.002	

Figure 3 Oxygen level in the samples



CHEMICAL COMPOSITION

The chemical composition was checked in certified laboratory.
Test were performed by ICP-OES method. ,

Table 4 Chemical composition of titanium powder and titanium wire #

Requirements for Ti6Al4V grade [%]		Titanium powder	U _B ⁽¹⁾	Titanium wire	U _B ⁽¹⁾	Test methods
		Test results [%]				
Al	5.50 ... 6.75	6.0	0.4	6.6	0.5	BOSMAL/I-7-43/06
V	3.50 ... 4.50	4.0	0.3	4.0	0.3	
Fe	≤ 0.40	0.28	0.02	0.21	0.02	
C	≤ 0.08	0.025	0.002	0.022	0.002	PN-EN ISO 15350:2010
N	≤ 0.05	< 0.005	-	< 0.005	-	PN-EN ISO 15350:2010
H	≤ 0.015	0.0047	0.0005	0.0053	0.0005	LECO methodology
O	≤ 0.20	0.0039	0.0004	0.0036	0.0004	
Cu	-	0.036	0.003	< 0.01	-	BOSMAL/I-7-43/06
W	-	< 0.05	-	< 0.05	-	
Ti	balance	balance	-	balance	-	

⁽¹⁾ U_B – total expanded uncertainty of category B (confidence level 0.95)

FLOWABILITY

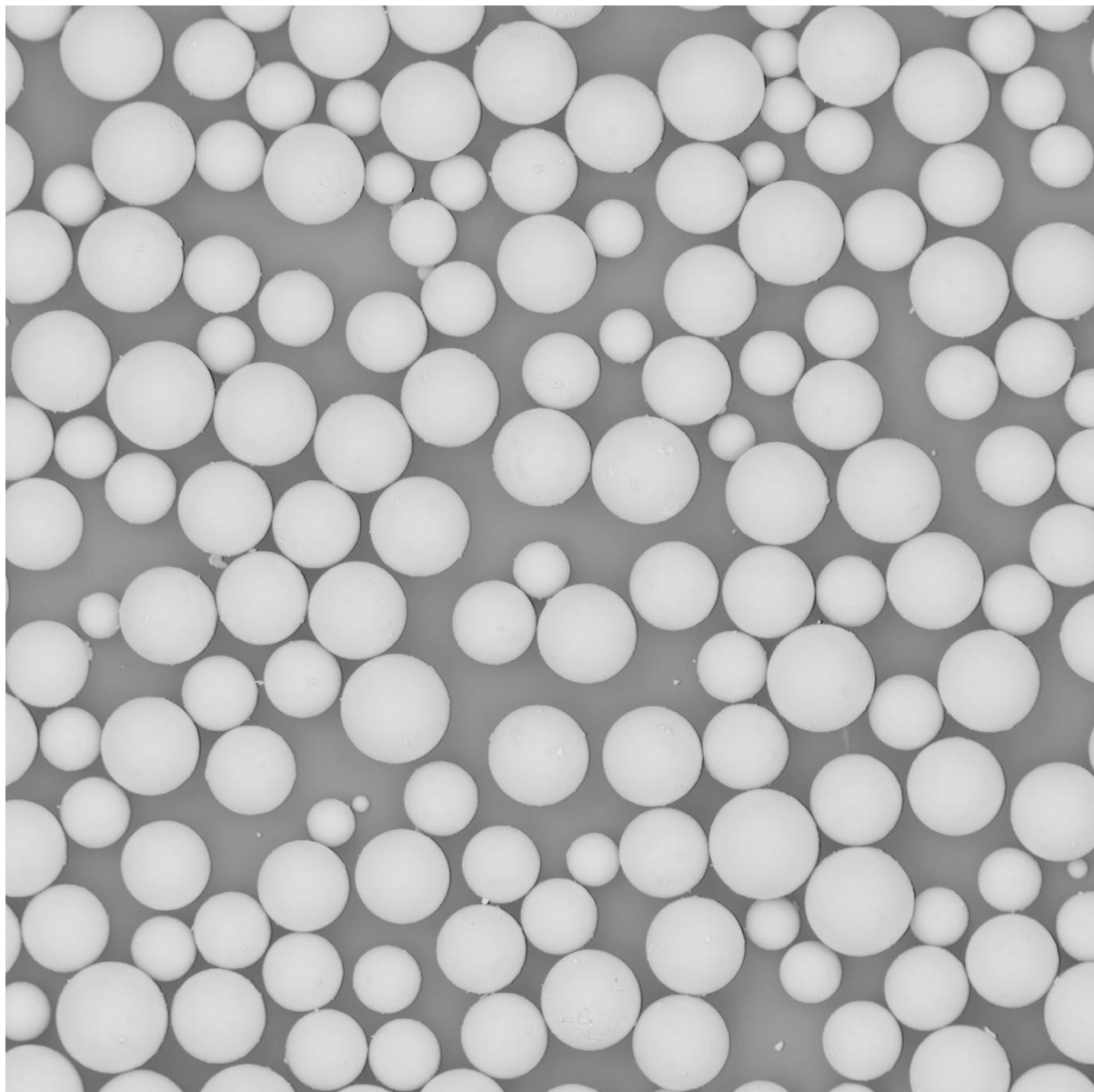
Flowability was checked with a Hall flowmeter (ISO 4490)

Table 5 Flowability measurement result

No	Sample	Flow time [s]
1	Ti.Gr5	27,9

SEM

Figure 4 SEM photo of Titanium Grade 5



OVERALL CONCLUSION

For Titanium Grade 5 average measured particle diameter was 57 μm . Particles have good sphericity without any defects. The process of atomization of the Titan Grade 5 was very stable and predictable. Process efficiency oscillated around 94% and 0,5 kg/h.