NATIONAL BUREAU OF STANDARDS REPORT

9909

IMPACT PROPERTIES OF ALUMINUM ALLOY – BETA SILICON CARBIDE WHISKER COMPOSITES

To

Melpar, Inc.
(USAF Contract No. F33615–68–C–1064)



U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

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NATIONAL BUREAU OF STANDARDS

The National Bureau of Standards[1] was established by an act of Congress March 3, 1901. Today, in addition to serving as the Nation's central measurement laboratory, the Bureau is a principal focal point in the Federal Government for assuring maximum application of the physical and engineering sciences to the advancement of technology in industry and commerce. To this end the Bureau conducts research and provides central national services in three broad program areas and provides central national services in a fourth. These are: (1) basic measurements and standards, (2) materials measurements and standards, (3) technological measurements and standards, and (4) transfer of technology.

The Bureau comprises the Institute for Basic Standards, the Institute for Materials Research, the Institute for Applied Technology, and the Center for Radiation Research.

THE INSTITUTE FOR BASIC STANDARDS provides the central basis within the United States of a complete and consistent system of physical measurement, coordinates that system with the measurement systems of other nations, and furnishes essential services leading to accurate and uniform physical measurements throughout the Nation's scientific community, industry, and commerce. The Institute consists of an Office of Standard Reference Data and a group of divisions organized by the following areas of science and engineering:

Applied Mathematics—Electricity—Metrology—Mechanics—Heat—Atomic Physics—Cryogenics[2]—Radio Physics[2]—Radio Engineering[2]—Astrophysics[2]—Time and Frequency.[2]

THE INSTITUTE FOR MATERIALS RESEARCH conducts materials research leading to methods, standards of measurement, and data needed by industry, commerce, educational institutions, and government. The Institute also provides advisory and research services to other government agencies. The Institute consists of an Office of Standard Reference Materials and a group of divisions organized by the following areas of materials research:

Analytical Chemistry—Polymers—Metallurgy — Inorganic Materials — Physical Chemistry.

THE INSTITUTE FOR APPLIED TECHNOLOGY provides for the creation of appropriate opportunities for the use and application of technology within the Federal Government and within the civilian sector of American industry. The primary functions of the Institute may be broadly classified as programs relating to technological measurements and standards and techniques for the transfer of technology. The Institute consists of a Clearinghouse for Scientific and Technical Information,[3] a Center for Computer Sciences and Technology, and a group of technical divisions and offices organized by the following fields of technology:

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THE CENTER FOR RADIATION RESEARCH engages in research, measurement, and application of radiation to the solution of Bureau mission problems and the problems of other agencies and institutions. The Center for Radiation Research consists of the following divisions:

Reactor Radiation—Linac Radiation—Applied Radiation—Nuclear Radiation.

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[1] Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D. C. 20234.
[2] Located at Boulder, Colorado 80302.
[3] Located at 5285 Port Royal Road, Springfield, Virginia 22151.

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U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

Impact Properties of Aluminum Alloy - Beta Silicon Carbide Whisker Composites

Material: Thirty-one subsize Charpy V-notch impact test specimens were submitted by the Materials Laboratory, Melpar, Incorporated for tests. The test material included specimens machined from extruded 2024, 6065, and 7075 aluminum alloy blanks and specimens machined from extruded 2024, 6065, and 7075 aluminum alloy - silicon carbide composites.

Test Specimens: Figure 1 shows the configuration of the subsize impact test specimen and contains pertinent dimensions.

Test Procedure and Equipment: All specimens were conditioned at room temperature (70° F) for at least one-half hour before testing. They were broken in a Baldwin 2 foot pound capacity impact tester. This machine has a C-type pendulum. The striker is rounded to a radius of 0.125 inches and the points of specimen support are 1.78 inches apart. Figure 2 is a view of the impact tester with a test specimen in place for testing.

Test Results: Table 1 gives the test results.

Table 1. Charpy Impact Properties of Aluminum Alloy Blanks and Aluminum Alloy - Beta Silicon Carbide Whisker Composites

Melpar Specimen Identification	Energy Absorbed Foot Pounds	Remarks
Al 2024 Blanks, IHTB 31		
Spec. 1	0.250	
2	.235	
3	.256	
4	.236	
Avg.	.244	
Al 2024 Composites, VHTL 42		
Spec. 1	0.017	
2	.017	
3	.019	Some cladding
4	.015	
Avg.	.017	
Alloy 889 (Al 97 1/2% - Si 2 1/2%) Blanks		
Spec. 1	0.572	
2	.531	
3	.527	
4	.606	
Avg.	.559	
Alloy 889 (Al 97 1/2% - Si 2 1/2%) Composites, VSSL 43		
Spec. 1	0.0440	
2	.0380	0.121 In. notch depth, 0.151 In. square.
3	.0320	0.115 In. notch depth, 0.143 In. square.
Avg.	.0380	
Alloy 889 (Al 97 1/2% - Si 2 1/2%) Composites, VSSM 44		
Spec. 1	0.027	
2	.026	
3	.031	
Avg.	.028	

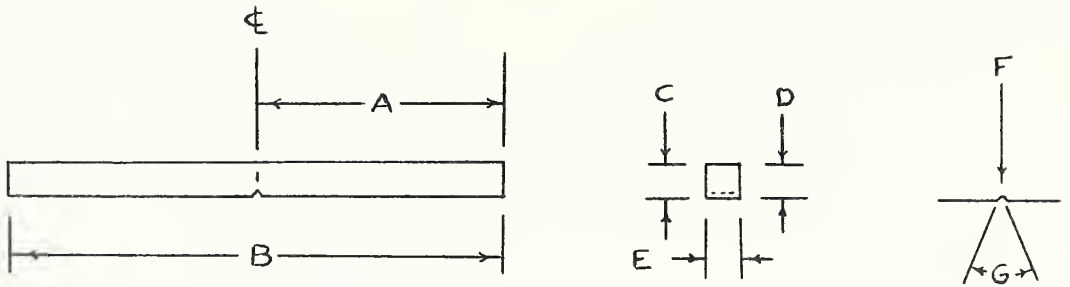
Table 1. Continued

Melpar Specimen Identification	Energy Absorbed Foot Pounds	Remarks
Al 7075 Composites, VHTB 32		
Spec. A	0.250	
B	.190	
C	.255	
D	.238	
Avg.	.233	
Al 6061 Composites, VHTM 45		
Spec. 1	0.027	
2	.027	
3	.030	
4	.031	
5	.033	
Avg.	.030	
Al 7075 Composites, VHTL 41		
Spec. A	0.017	
B	.016	
C	.005	
D	.018	
Avg.	.014	

Remarks: With only one exception, specimen C, Al 7075 Composite, VHTL 41, test results showed little scatter. Shear lips indicative of good ductility were observed on the fracture surfaces of all of the aluminum alloy blank specimens. The fracture surfaces of the composite specimens were generally flat indicating embrittlement.

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FIGURE 1. SUBSIZE IMPACT SPECIMEN
MELPAR TESTS



DIMENSION	INCHES	TOLERANCE (Inches) +	-
A - Center to End	1/2 B		
B - Length	2.56	0	0.05
C - Cross Section (Depth)	0.156	0.001	0.001
D - Notch to Base	0.125	0.001	0.001
E - Cross Section (Width)	0.156	0.001	0.001
F - Radius of Notch	0.010	0.001	0.001
G - Angle of Notch	45°	Plus or Minus 1°	
Suggested out of Square (of Cross Section)		0.15° (9 min.)	

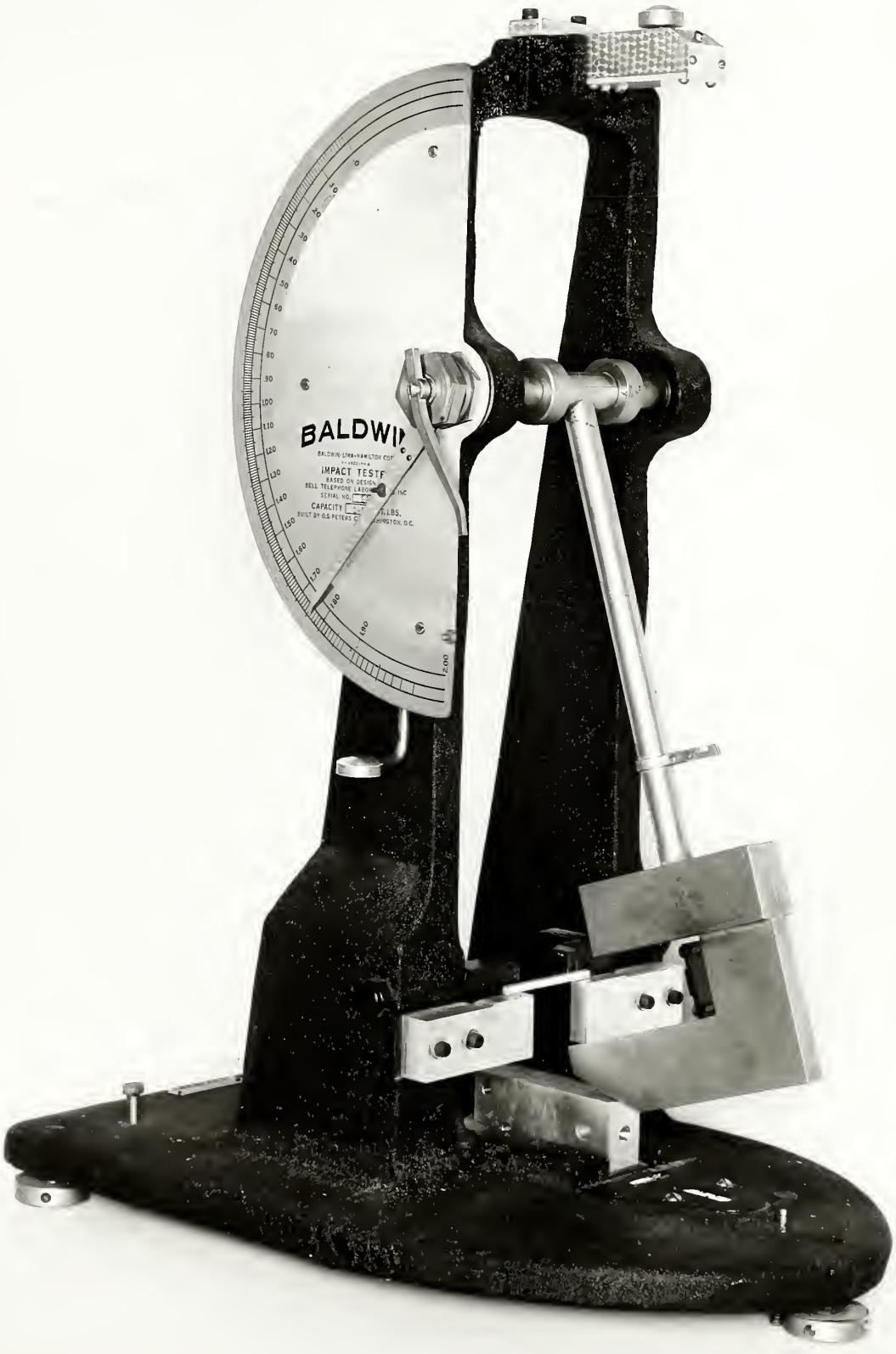


Figure 2. Baldwin Impact Tester - 2 foot pound capacity.


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