LexTech

AFGROW.NET

AFGROW Workshop 2010 - Layton, UT

Using the On-Line Material Database

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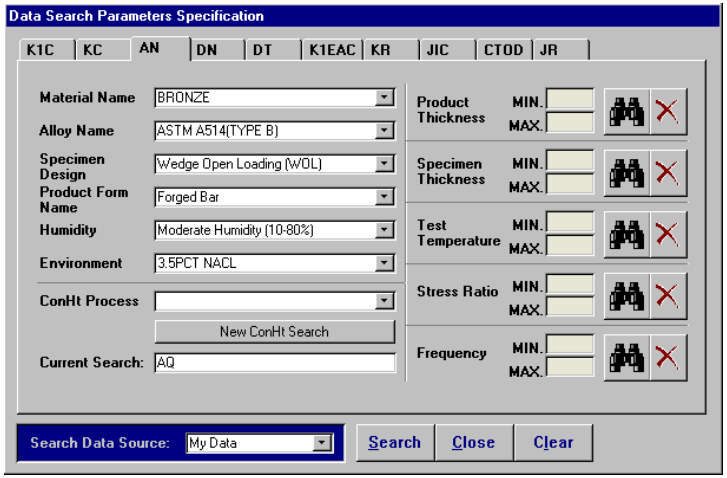
Observations

- Damage tolerance evaluations of aircraft structures are never better than the quality, applicability, and availability of the material properties used for the analyses.
- Test data are needed to generate input for life prediction applications and to validate the results
- Data exists but is not easily accessible or searchable

CRACK GROWTH DATABASE V3.1 for Windows 95 and ACCESS 97



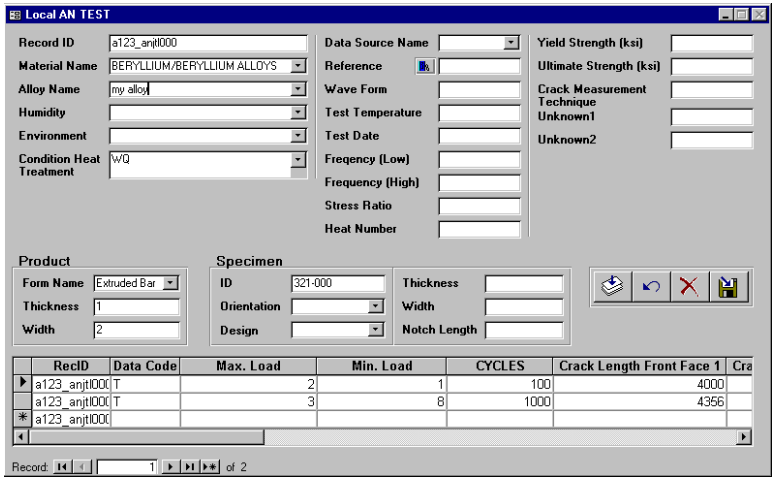
- Developed at Purdue University under contract with AFRL-VASM
- Desktop application
- Needed MS ACCESS to be installed
- Super Slow
- Unsupported Scripting Language, that made database unusable
- Hard to search

Goals

- Create an interactive database solution to collect, store and present data
- Make it the foundation for an application that can store material data for crack growth analysis
- Allow seamless integration with other applications

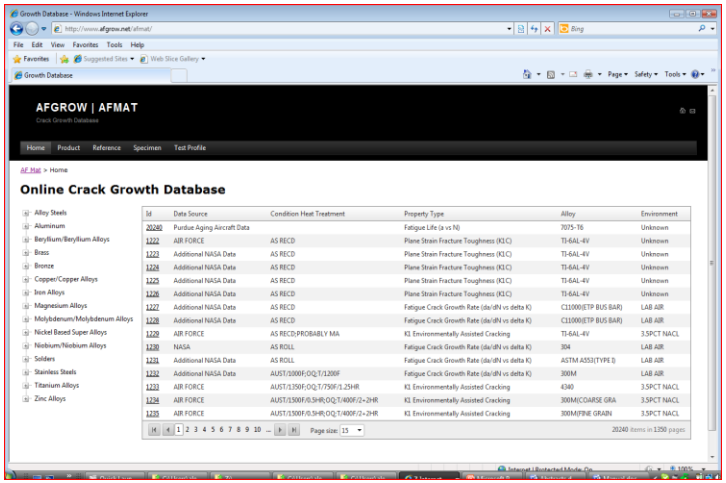
CRACK GROWTH DATABASE ⟹ AFMAT

Was



- Desktop application
- Hard to search
- Obsolete technology
- Unstructured data

Now



- Web based
- More ways to search data
- Easy to Use/Always up to date
- Structured data

AFMAT Content

- Came from 3 (5) different organizations
- 1229 Sources/Publications
- 11 Different property types
- More that 600 different materials (metals)
- These data can not be used directly as input for crack growth prediction without preprocessing

AFMAT Content – Sources

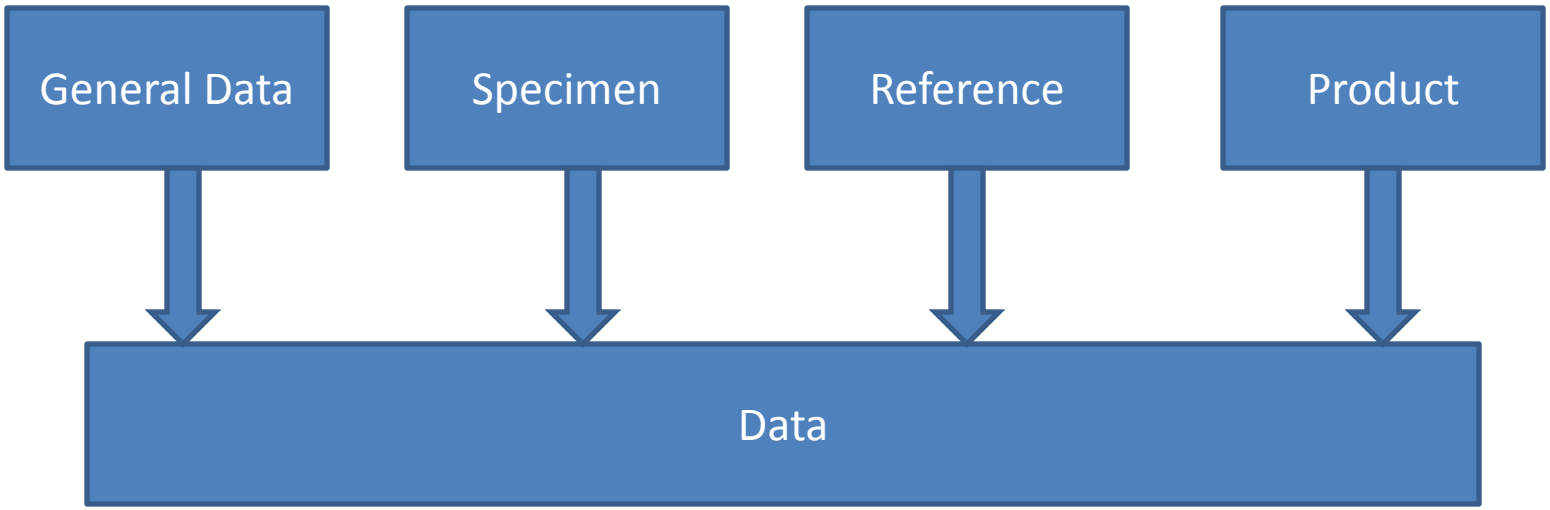
Total data entries: 20240

- NASA - 1574
- AIR FORCE - 11850
- NASA - Johnson Space Center - 31
- Purdue Aging Aircraft Data - 77
- Additional NASA Data - 6708

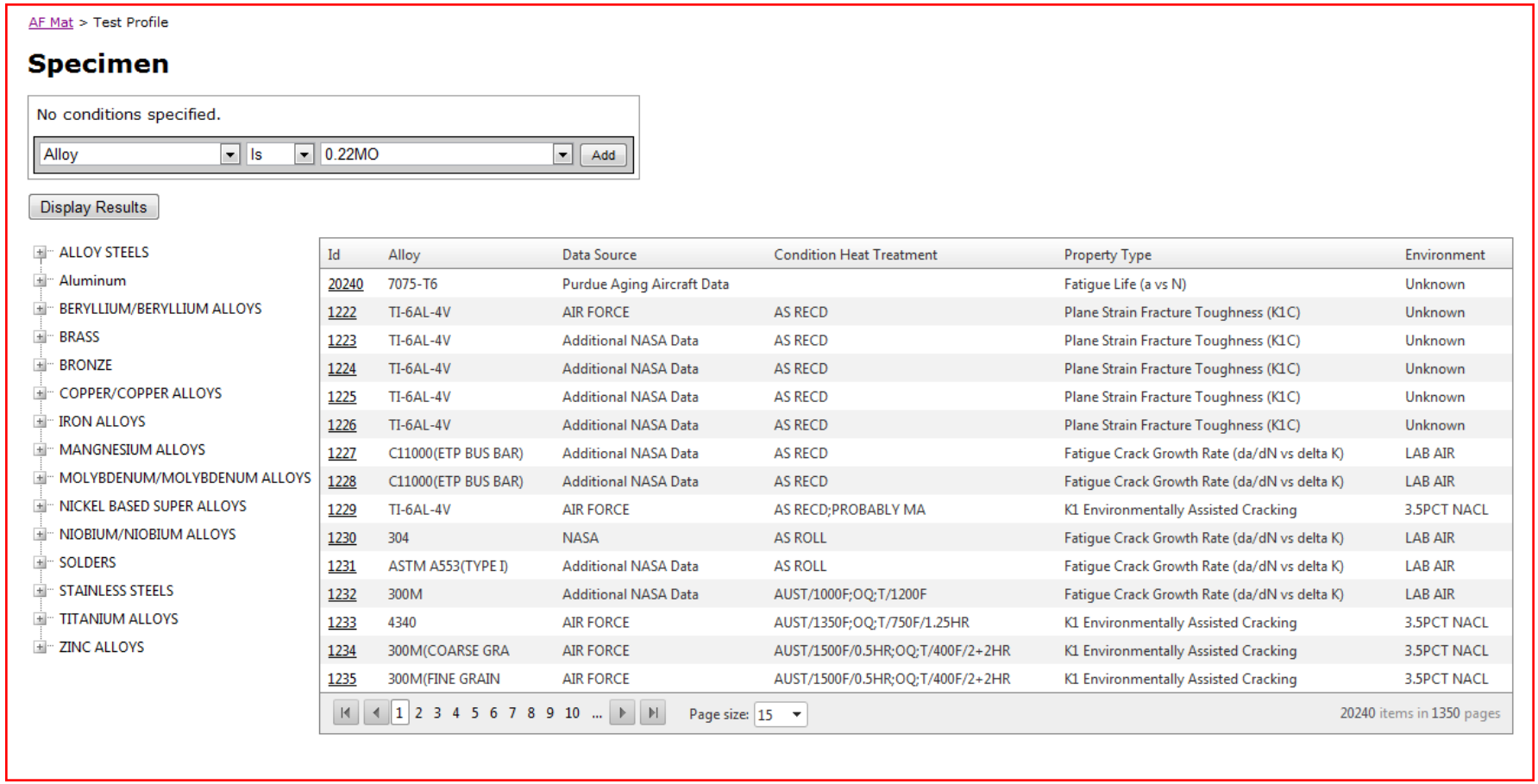
AFMAT Content – Property Types

- Plane Strain Fracture Toughness (K1C) - 7394
- Plane Stress Fracture Toughness (KC) - 3927
- Fatigue Life (a vs N) - 2133
- Fatigue Crack Growth Rate (da/dN vs delta K) - 5336
- Sustained Load Growth Rate (da/dt vs Kmax) - 112
- K1 Environmentally Assisted Cracking - 469
- R-Curve (KR) - 89
- J-Integral Fracture Toughness - 276
- Fracture Toughness Measured By CTOD - 125
- R-Curve (JR) - 378

Data Structure



Everything is Referenced to the Material



AF Mat > Test Profile

Specimen

No conditions specified.

Alloy | Is | 0.22MO | Add

Display Results

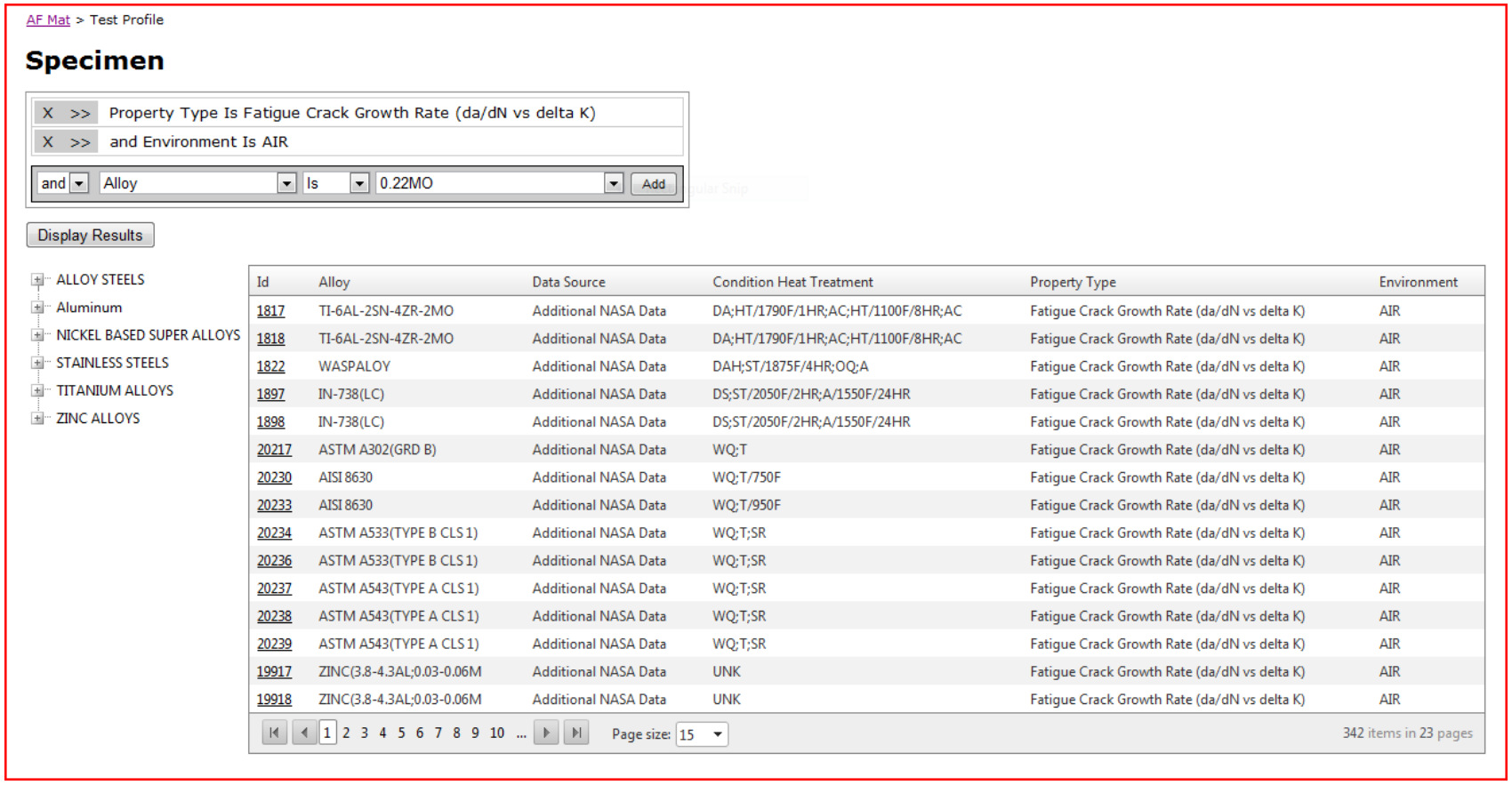
- ALLOY STEELS
- Aluminum
- BERYLLIUM/BERYLLIUM ALLOYS
- BRASS
- BRONZE
- COPPER/COPPER ALLOYS
- IRON ALLOYS
- MANGNESIUM ALLOYS
- MOLYBDENUM/MOLYBDENUM ALLOYS
- NICKEL BASED SUPER ALLOYS
- NIOBIUM/NIOBIUM ALLOYS
- SOLDERS
- STAINLESS STEELS
- TITANIUM ALLOYS
- ZINC ALLOYS

Id	Alloy	Data Source	Condition Heat Treatment	Property Type	Environment
20240	7075-T6	Purdue Aging Aircraft Data		Fatigue Life (a vs N)	Unknown
1222	TI-6AL-4V	AIR FORCE	AS RECD	Plane Strain Fracture Toughness (K1C)	Unknown
1223	TI-6AL-4V	Additional NASA Data	AS RECD	Plane Strain Fracture Toughness (K1C)	Unknown
1224	TI-6AL-4V	Additional NASA Data	AS RECD	Plane Strain Fracture Toughness (K1C)	Unknown
1225	TI-6AL-4V	Additional NASA Data	AS RECD	Plane Strain Fracture Toughness (K1C)	Unknown
1226	TI-6AL-4V	Additional NASA Data	AS RECD	Plane Strain Fracture Toughness (K1C)	Unknown
1227	C11000(ETP BUS BAR)	Additional NASA Data	AS RECD	Fatigue Crack Growth Rate (da/dN vs delta K)	LAB AIR
1228	C11000(ETP BUS BAR)	Additional NASA Data	AS RECD	Fatigue Crack Growth Rate (da/dN vs delta K)	LAB AIR
1229	TI-6AL-4V	AIR FORCE	AS RECD;PROBABLY MA	K1 Environmentally Assisted Cracking	3.5PCT NACL
1230	304	NASA	AS ROLL	Fatigue Crack Growth Rate (da/dN vs delta K)	LAB AIR
1231	ASTM A553(TYPE I)	Additional NASA Data	AS ROLL	Fatigue Crack Growth Rate (da/dN vs delta K)	LAB AIR
1232	300M	Additional NASA Data	AUST/1000F;OQ;T/1200F	Fatigue Crack Growth Rate (da/dN vs delta K)	LAB AIR
1233	4340	AIR FORCE	AUST/1350F;OQ;T/750F/1.25HR	K1 Environmentally Assisted Cracking	3.5PCT NACL
1234	300M(COARSE GRA	AIR FORCE	AUST/1500F/0.5HR;OQ;T/400F/2+2HR	K1 Environmentally Assisted Cracking	3.5PCT NACL
1235	300M(FINE GRAIN	AIR FORCE	AUST/1500F/0.5HR;OQ;T/400F/2+2HR	K1 Environmentally Assisted Cracking	3.5PCT NACL

1 2 3 4 5 6 7 8 9 10 ... Page size: 15

20240 items in 1350 pages

Material – Filtered with the data

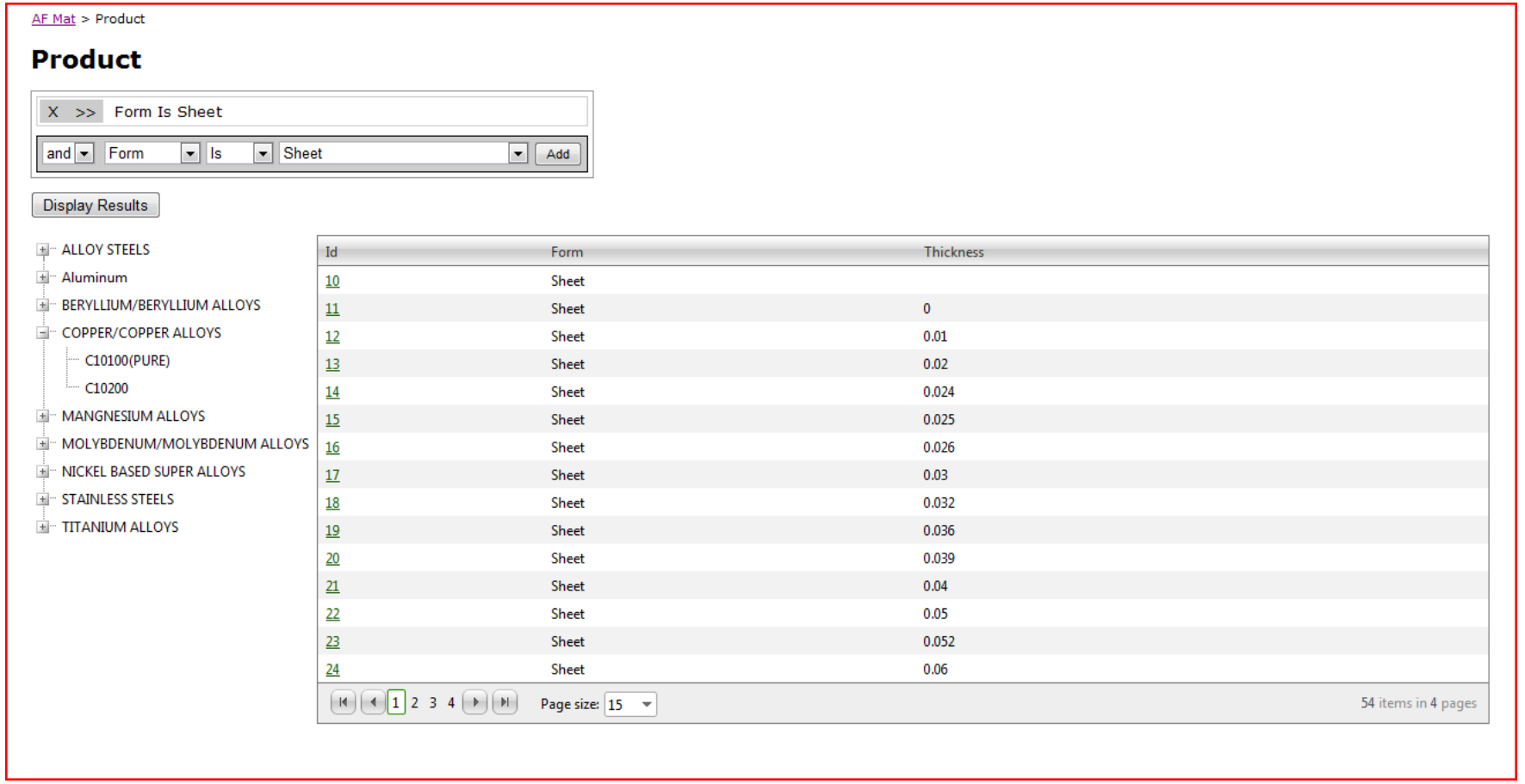


Id	Alloy	Data Source	Condition Heat Treatment	Property Type	Environment
1817	TI-6AL-2SN-4ZR-2MO	Additional NASA Data	DA;HT/1790F/1HR;AC;HT/1100F/8HR;AC	Fatigue Crack Growth Rate (da/dN vs delta K)	AIR
1818	TI-6AL-2SN-4ZR-2MO	Additional NASA Data	DA;HT/1790F/1HR;AC;HT/1100F/8HR;AC	Fatigue Crack Growth Rate (da/dN vs delta K)	AIR
1822	WASPALOY	Additional NASA Data	DAH;ST/1875F/4HR;OQ;A	Fatigue Crack Growth Rate (da/dN vs delta K)	AIR
1897	IN-738(LC)	Additional NASA Data	DS;ST/2050F/2HR;A/1550F/24HR	Fatigue Crack Growth Rate (da/dN vs delta K)	AIR
1898	IN-738(LC)	Additional NASA Data	DS;ST/2050F/2HR;A/1550F/24HR	Fatigue Crack Growth Rate (da/dN vs delta K)	AIR
20217	ASTM A302(GRD B)	Additional NASA Data	WQ;T	Fatigue Crack Growth Rate (da/dN vs delta K)	AIR
20230	AISI 8630	Additional NASA Data	WQ;T/750F	Fatigue Crack Growth Rate (da/dN vs delta K)	AIR
20233	AISI 8630	Additional NASA Data	WQ;T/950F	Fatigue Crack Growth Rate (da/dN vs delta K)	AIR
20234	ASTM A533(TYPE B CLS 1)	Additional NASA Data	WQ;T;SR	Fatigue Crack Growth Rate (da/dN vs delta K)	AIR
20236	ASTM A533(TYPE B CLS 1)	Additional NASA Data	WQ;T;SR	Fatigue Crack Growth Rate (da/dN vs delta K)	AIR
20237	ASTM A543(TYPE A CLS 1)	Additional NASA Data	WQ;T;SR	Fatigue Crack Growth Rate (da/dN vs delta K)	AIR
20238	ASTM A543(TYPE A CLS 1)	Additional NASA Data	WQ;T;SR	Fatigue Crack Growth Rate (da/dN vs delta K)	AIR
20239	ASTM A543(TYPE A CLS 1)	Additional NASA Data	WQ;T;SR	Fatigue Crack Growth Rate (da/dN vs delta K)	AIR
19917	ZINC(3.8-4.3AL;0.03-0.06M	Additional NASA Data	UNK	Fatigue Crack Growth Rate (da/dN vs delta K)	AIR
19918	ZINC(3.8-4.3AL;0.03-0.06M	Additional NASA Data	UNK	Fatigue Crack Growth Rate (da/dN vs delta K)	AIR

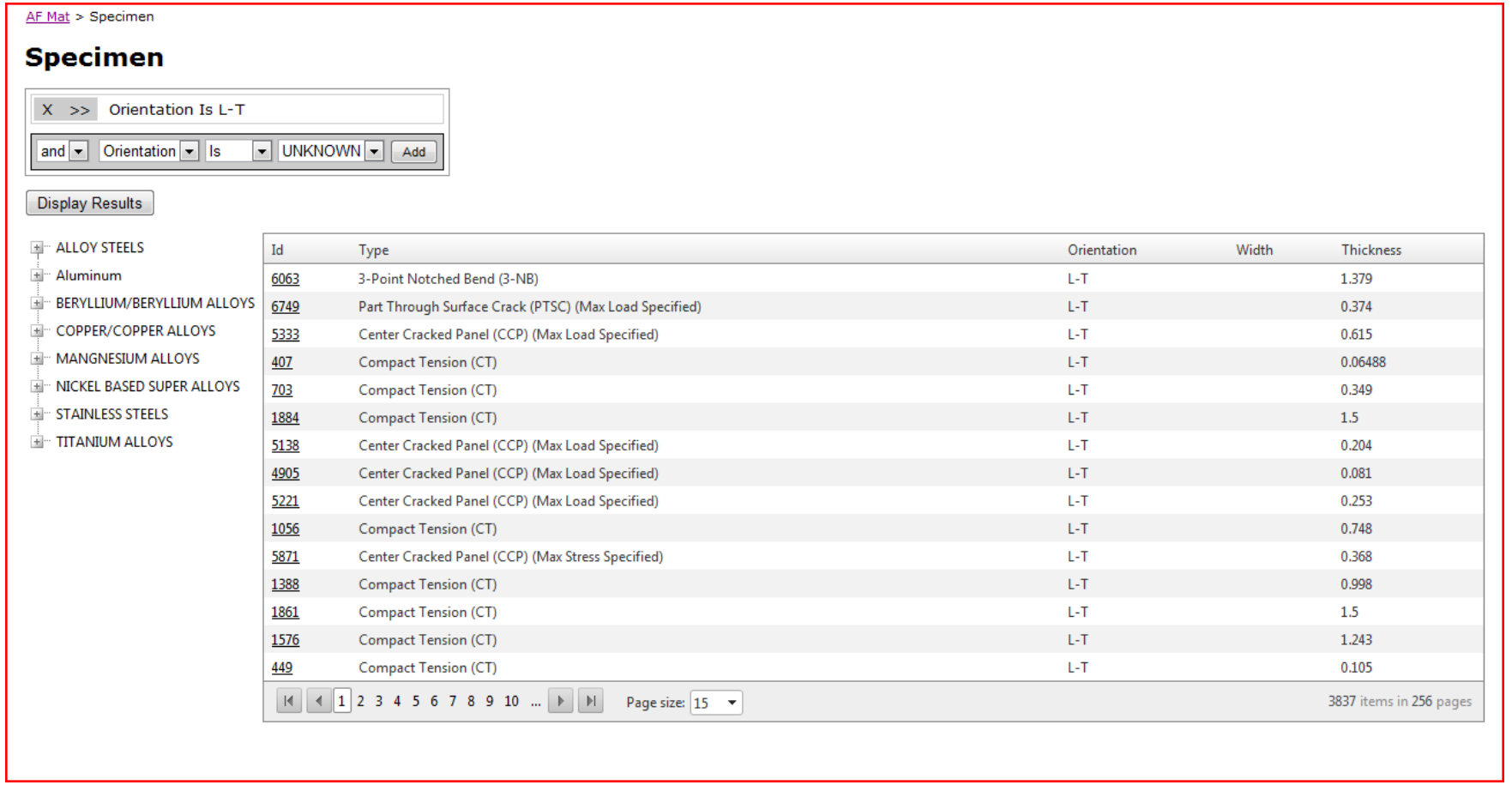
Search Options

- Material
- Product
- Specimen
- Reference
- Test Profile

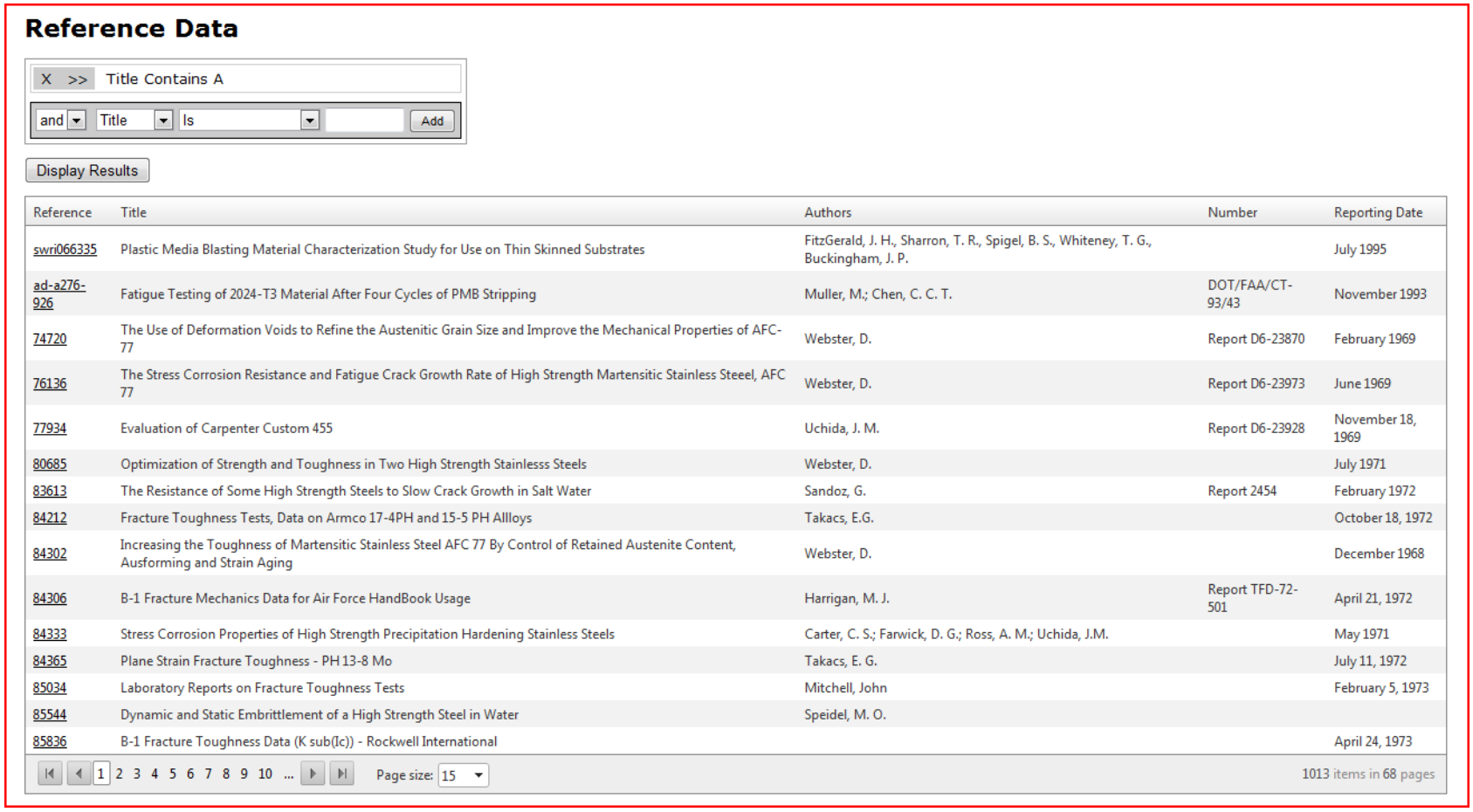
Start Search from Product



Start Search from Specimen



Search by Reference



Reference Data

X >> Title Contains A

and | Title | Is | | Add

Display Results

Reference	Title	Authors	Number	Reporting Date
swri066335	Plastic Media Blasting Material Characterization Study for Use on Thin Skinned Substrates	FitzGerald, J. H., Sharron, T. R., Spigel, B. S., Whiteney, T. G., Buckingham, J. P.		July 1995
ad-a276-926	Fatigue Testing of 2024-T3 Material After Four Cycles of PMB Stripping	Muller, M.; Chen, C. C. T.	DOT/FAA/CT-93/43	November 1993
74720	The Use of Deformation Voids to Refine the Austenitic Grain Size and Improve the Mechanical Properties of AFC-77	Webster, D.	Report D6-23870	February 1969
76136	The Stress Corrosion Resistance and Fatigue Crack Growth Rate of High Strength Martensitic Stainless Steeel, AFC 77	Webster, D.	Report D6-23973	June 1969
77934	Evaluation of Carpenter Custom 455	Uchida, J. M.	Report D6-23928	November 18, 1969
80685	Optimization of Strength and Toughness in Two High Strength Stainlesss Steels	Webster, D.		July 1971
83613	The Resistance of Some High Strength Steels to Slow Crack Growth in Salt Water	Sandoz, G.	Report 2454	February 1972
84212	Fracture Toughness Tests, Data on Armco 17-4PH and 15-5 PH Allloys	Takacs, E.G.		October 18, 1972
84302	Increasing the Toughness of Martensitic Stainless Steel AFC 77 By Control of Retained Austenite Content, Ausforming and Strain Aging	Webster, D.		December 1968
84306	B-1 Fracture Mechanics Data for Air Force HandBook Usage	Harrigan, M. J.	Report TFD-72-501	April 21, 1972
84333	Stress Corrosion Properties of High Strength Precipitation Hardening Stainless Steels	Carter, C. S.; Farwick, D. G.; Ross, A. M.; Uchida, J.M.		May 1971
84365	Plane Strain Fracture Toughness - PH 13-8 Mo	Takacs, E. G.		July 11, 1972
85034	Laboratory Reports on Fracture Toughness Tests	Mitchell, John		February 5, 1973
85544	Dynamic and Static Embrittlement of a High Strength Steel in Water	Speidel, M. O.		
85836	B-1 Fracture Toughness Data (K sub(Ic)) - Rockwell International			April 24, 1973

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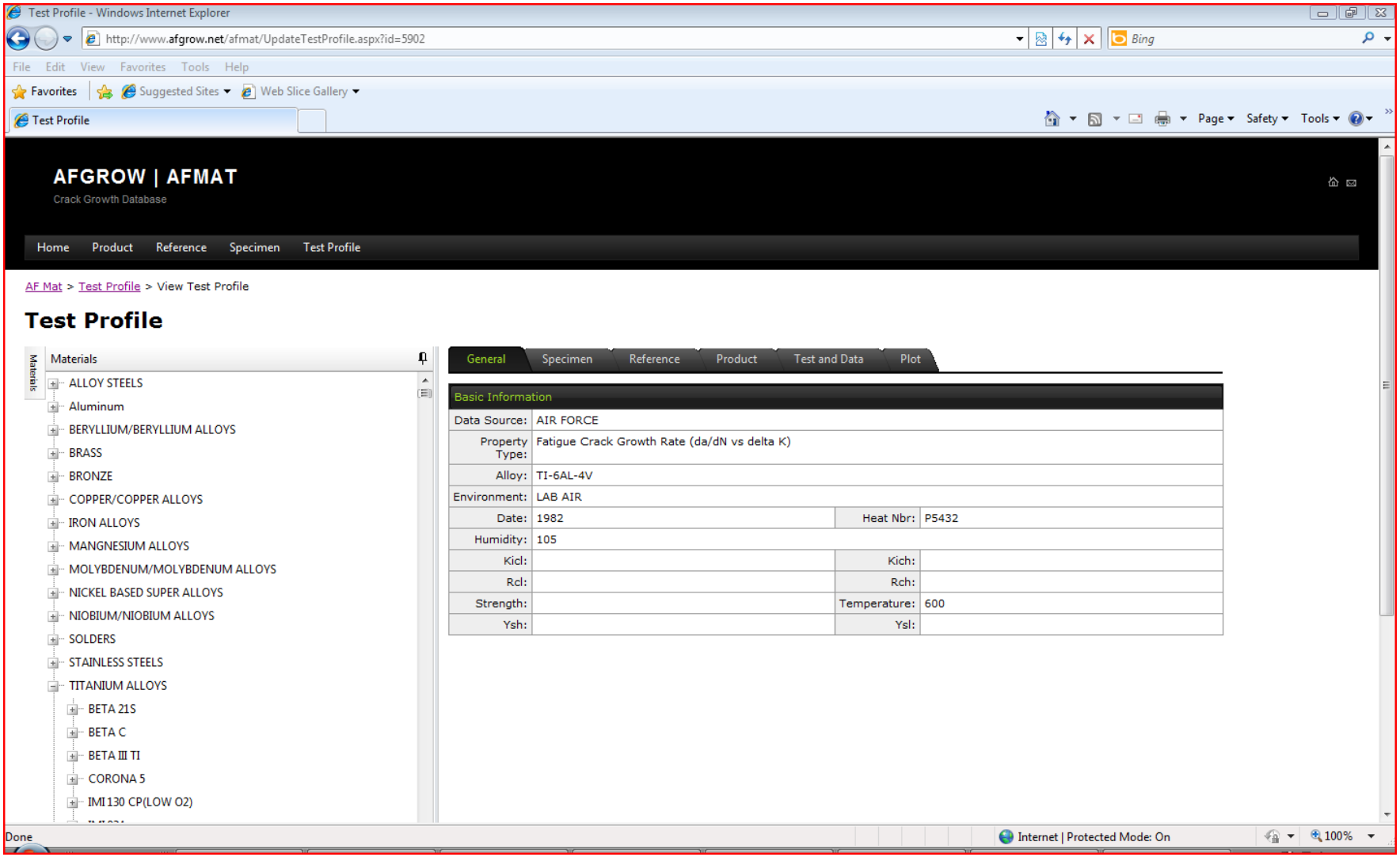
1013 items in 68 pages

Test Profile Information



Future Development

- Web services interface (will enable desktop applications to view data)
- Save search results
- Save test profile to my favorites
- Add more data
- Add processed data (data that could be input to crack growth analysis software)