Materials

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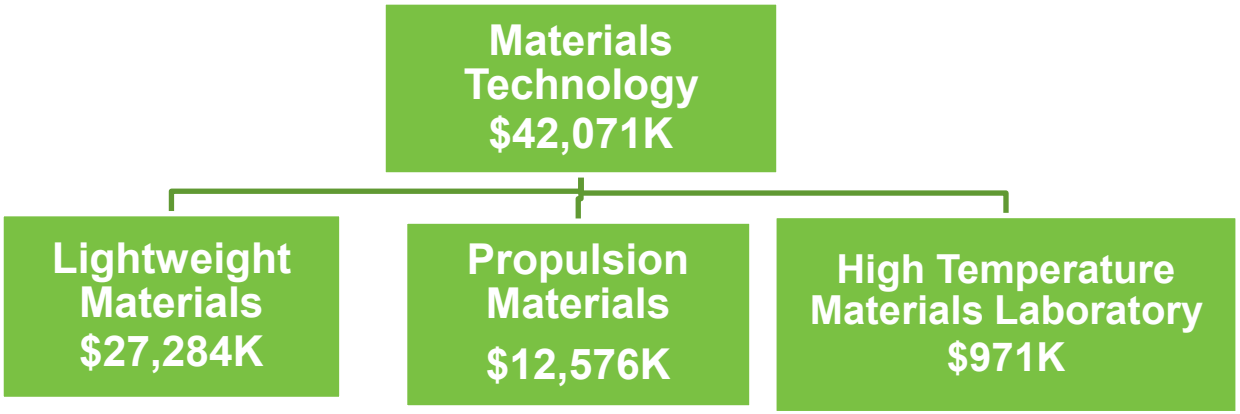
Materials Technology Budget by Activities

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

	FY'11 $K	FY'12 $K	FY'13 $K
Major Activity	CR value	Appropriations	Request
Materials Technology	49,620	42,071	50,000
Lightweighting Materials	29,097	27,284	38,780
Propulsion Materials	12,962	12,576	9,695
HTML	5,662	971	0
SBIR/STTR	1,375	1,241	1,525

Materials Technology Goals FY 2012



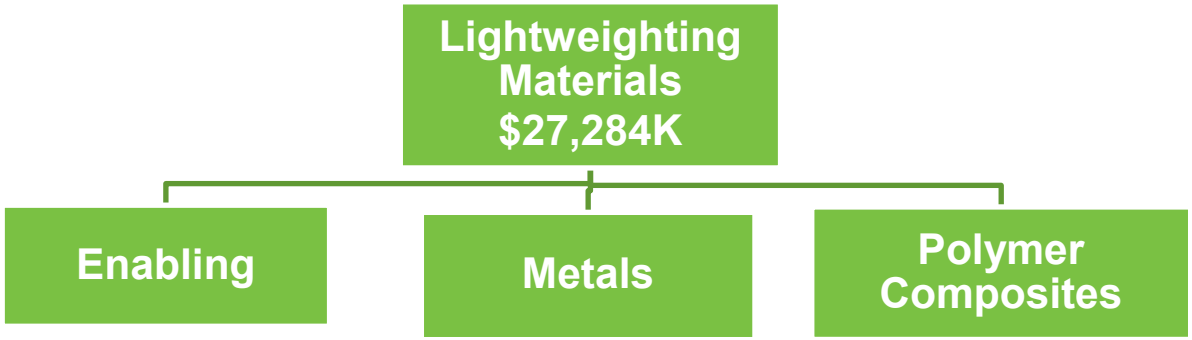
By 2015, validate (to within 10% uncertainty) cost-effective weight reduction of passenger vehicle body and chassis systems by 50% with recyclability comparable to 2002 vehicles

Develop high performance cost-effective materials to address key technical materials deficiencies limiting the performance of propulsion systems

Provide state-of-the-art materials characterization facility to resolve materials-related barriers impeding the success of VTP research

Lightweighting Materials Structure and Benefits

Goal: By 2015, validate (to within 10% uncertainty) cost-effective weight reduction of passenger vehicle body and chassis systems by 50% with recyclability comparable to 2002 vehicles



Vehicle class (weight reduction target)	Fuel Efficiency improvement % (per vehicle)	Reduced Fuel Use % (per vehicle)	GHG reduction % (per vehicle)
Cars (30%)	**21**	**17**	**17**
Cars (50%)	**35**	**26**	**26**

Benefits assume that for each increment of 10% weight reduction a benefit of 7% efficiency is realized. (1.)

1. Duleep, K. G. “Analysis of Light Duty Vehicle Weight Reduction Potential” July 2007 p. 1-3

Data and analyses provided by P. Patterson VTP, DOE

Lightweighting Materials

Goal: By 2015, validate (to within 10% uncertainty) cost-effective weight reduction of passenger vehicle body and chassis systems by 50% with recyclability comparable to 2002 vehicles

BAA/Solicitation (NETL)

Predictive Modeling for Automotive Lightweighting Applications and Advanced Alloy Development for Automotive and Heavy-Duty Engines

Predictive Engineering Carbon Fiber Composites

ICME 3rd Generation AHHS

Cast Lightweight Alloy Development for for Light-Duty Engine Automotive Applications

Cast High-Strength Alloy Development for Heavy-Duty Engine Applications

Reduce the weight of the vehicle by 50%
Enable downsized (lighter weight) engines that withstand higher peak cylinder pressures (metric here)
The objective is to develop a lightweight material that can enable light-duty engines to REDUCE WEIGHT AND increase their efficiency by 30%
Develop a high strength material that can enable heavy-duty engines to increase their efficiency by 30%

Weight Reduction Potential of Materials

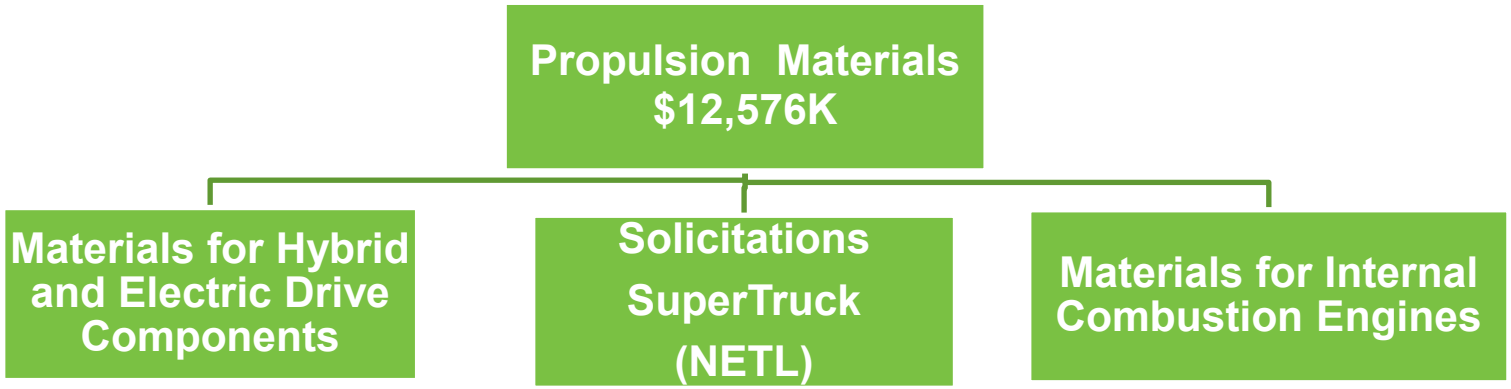
Lightweight Material	Material Replaced	Mass Reduction (%)
Magnesium	Steel, Cast Iron	60 - 75
Carbon Fiber Composites	Steel	50 - 60
Aluminum Matrix Composites	Steel , Cast Iron	40 - 60
Aluminum	Steel, Cast Iron	40 - 60
Titanium	Alloy Steel	40 - 55
Glass Fiber Composites	Steel	25 - 35
Advanced High Strength Steel	Mild Steel, Carbon Steel	15 - 25
High Strength Steel	Mild Steel	10 - 15

Program Staff - Office of Transportation Technologies, Energy Efficiency and Renewable Energy, Office of Advanced Automotive Technologies R&D Plan -Energy Efficient Vehicles for a Cleaner Environment, DOE/ORO/2065, March (1998) pp. 75 - 88.

Propulsion Materials

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Goal: Develop high performance cost-effective materials to address key technical materials deficiencies limiting the performance of advanced combustion engines, electric-drive systems, and use of renewable fuels



Goal: Provide state-of-the-art materials characterization facility to resolve materials-related barriers impeding the success of VTP research

HTML (ORNL)
$971K

Significant Accomplishments

Multimaterial joining – Mg

- Prototype-scale demonstration new laser-assisted self piercing rivet and friction stir weld (USAMP)

RT Processing of Al alloys-

- Enhanced formability using pulse pressure forming **2.5x to 6x** increase in safe strains (PNNL)

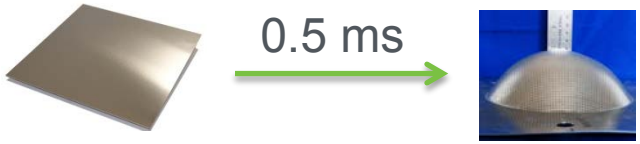
Non-Rare Earth Mg Alloy

- Significantly improve ductility crash energy absorption (PNNL)

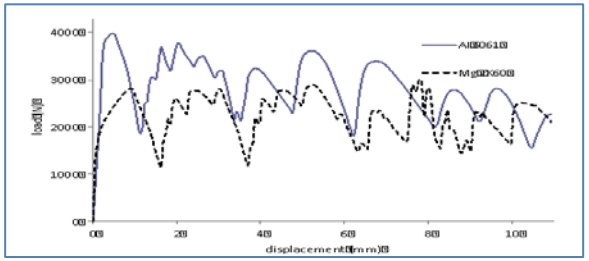
Propulsion Material developed Cast austenitic stainless steels for turbocharger housings and turbine-wheel/shaft assemblies (ORNL/Honeywell)

- CF8C-Plus with greater strength than HK30Nb stainless alloy > 750oC
- Better creep resistance
- Lower cost by 33% than HK30-Nb alloy

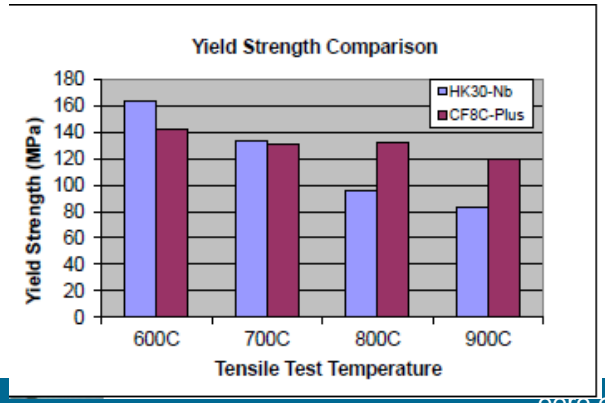
Joining demonstration: laser assisted (left) self piercing rivet and FSW (right)



Al RT Pulse Pressure Forming



Mg alloy with comparable crash energy to Al with 20% weight savings



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