Thermite

by Tetranitrate on December 6, 2006

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intro: Thermite

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Quick explanation of thermite:

A mixture of iron oxide Fe2O3 (rust) and aluminum powder. When it is ignited the aluminum powder reacts with the O3 part of the rust in a highly exothermic reaction, the resulting product is molten iron.

Thermite is commonly used in welding, because the molten iron has the ability to seep into cracks in metal. It cal also be used to melt through things as shown in an episode of Brainiac and the movie The Sixth Day.

I have made thermite a few times, but never in large enough batches to burn through anything significant. Aluminum powder is hard to come by and I never had a good enough reason to use what little powder I had.

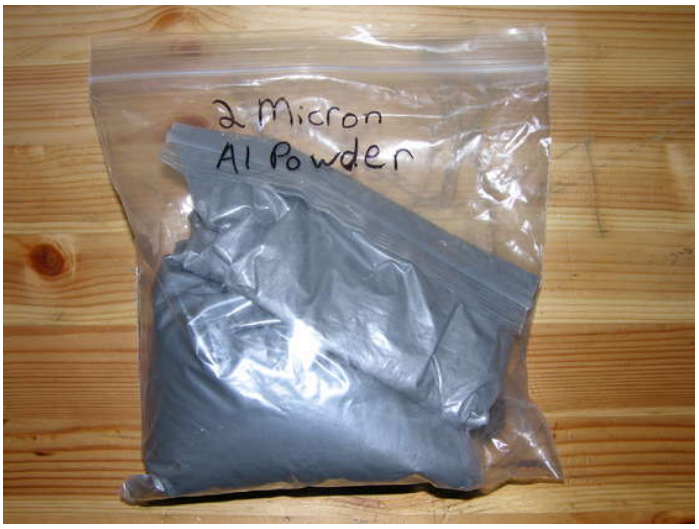
step 1: Materials

All materials can be found here http://unitednuclear.com/chem.htm or on E-bay. You can either buy and mix the chemicals yourself or buy premade thermite from unitednuclear.

1. Iron oxide
2. Aluminum powder
3. Magnesium ribbon or thermite ignition mixture

For a more exotic mix you may also want to buy:

4. Barium Nitrate
5. Sulfur
6. Dextrin



step 2: Mix

Mix 76.3% iron oxide with 27.3% aluminum powder to make thermite.

To make the military version Thermate create a mixture of 68.7% thermite, 29.0% barium nitrate, sulfur 2.0%, and dextrin 0.3%.

step 3: Ignition

The safest container to hold the thermite while igniting it is a terracotta or ceramic plant pot with a hole in the bottom. Place a tissue or coffee filter on the bottom of the pot to prevent the thermite from spilling through. Put the thermite in the pot, and then when it ignites it will burn through the paper spilling molten iron onto whatever is underneath.

Thermite requires extremely high temperatures to ignite (about 4000 F). Ignition can be achieved in multiple ways.

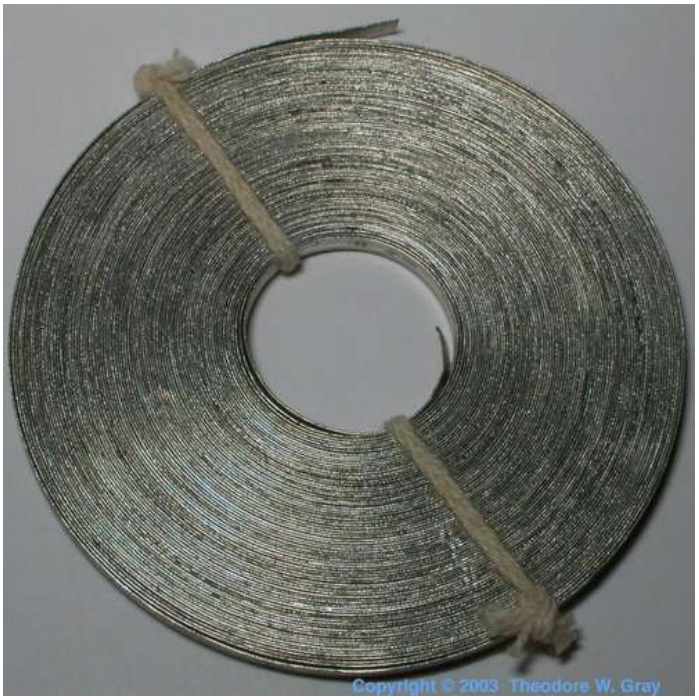
Magnesium ribbon, although unreliable, is still the most popular way to ignite thermite.

Sparklers

Thermite ignition formula sold on unitednuclear

A mixture of Potassium permanganate and glycerine will undergo a reaction that can provide enough heat to ignite thermite.

Allow yourself at least 10 seconds to get the hell away from this stuff, especially if you made Thermate.



step 4: Safety

Thermite burns very hot. It is virtually impossible to extinguish. Do not pour water on it because it will not extinguish it and it give you steam burns in the process. If you are having this burn through something put a bucket of sand underneath it.

Only do this outdoors in a completely nonflammable environment.

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scratch_and_sniff_bandit says: Feb 12, 2009. 5:57 PM REPLY

so heres the skinny, unless you're in the army or welding railroads, thermite is Fe2O3 + 2Al----->(nobody cares what it yields)
there are different formulas for it but for the sake of just "meltn' stuff" thats what has been posted in most of the instructables here

i post this because the mass seems very debated,
what are formulas? mole to mole ratios so it is 1:2 (1 iron(III)oxide and 2 aluminum)
so for one mole of thermite we need 1mole(159.69g) of the oxide and 2moles(53.96g) of aluminum...

and thats with proper sig figs :-)

if anyone sees any problem with this tell me

PKTraceur says: May 3, 2009. 5:03 PM REPLY

Are you using aluminium mole equals 26.89 g? I think thats right.

-PKT

geeklord says: Apr 22, 2009. 5:22 PM REPLY

What about magnesium shavings and iron oxide? I've got one of thosewal-mart firesteel/magnesium cheapo fire starter things.

chip123 says: Feb 8, 2009. 7:58 AM REPLY

sorry to be a smart arse, but the percentages of the mix add up to more than 100%.

if you mix 76.3% iron oxide with 27.3% aluminum powder, then you get 103.6% thermite. this doesnt make sense to me, so could you explain it a little please.

thanks

M4industries says: Apr 19, 2009. 12:50 PM REPLY

I saw that too!

santy22 says: Mar 17, 2009. 12:25 PM **REPLY**

he just wants to get fancy-ish woth that. mix 75 and 25. also, you can do aluminium powder grinding or blending aluminium paper!

vince 09 says: Apr 14, 2009. 1:37 PM **REPLY**

OK so I know you can get aluminum from an etch a sceh, or you can grind up a chunk of aluminum. i dont have an etch a sceh or a chunck of aluminum handy so, I was wondering if I could use chaff from a B-52 it is very fine aluminum. is almost looks like shiney hair but its aluminum... could I use that effectively or is it too thin, its like aluminum hair?

Demented says: Feb 2, 2009. 2:30 AM **REPLY**

Well getting any sort of fuse is literally impossible for me. Neither can I make my own. So just wondering... could I take apart my kettle and use that heating element instead? I don't suppose there is any sort of limit to that is there?

INSTRUCTUBAL says: Mar 22, 2009. 7:52 PM **REPLY**

just roll paper up and douse it in lghter fluid, for most horrid of cases.

santy22 says: Mar 17, 2009. 12:23 PM **REPLY**

How to make an iron man costume
Tools:
Thermite, sparklers, a pot, stairs and somebody right your same size.....

Demented says: Feb 2, 2009. 2:48 AM **REPLY**

Wait. If Etch A Sketch is aluminium, how is it attracted by magnet?

scratch_and_sniff_bandit says: Feb 12, 2009. 5:41 PM **REPLY**

i didnt think etch a sketch had magnets, just a scrapper that pulled off some of the aluminum and when you shook it it just stuck back cause it was so fine

mr.space says: Jan 6, 2009. 10:40 AM **REPLY**

... is there a substitute for barium nitrate?

mr.space says: Jan 5, 2009. 10:12 AM **REPLY**

you are brilliant... i couldn't seem to find any precise ratios, and you also provide the military version!!

wiebevandomburg.hotmail.com says: Nov 18, 2008. 12:29 PM **REPLY**

would sodium chlorate and sugar provide enough heat to ignite , and what is the difference between thermite and thermate

andygates says: Dec 22, 2008. 2:08 AM **REPLY**

Permanganate and glycerol will do it, but chlorate and sugar is too cool. It really is tough stuff to get going. A common-or-garden firework sparkler is most fun.

Thermate is a variant formula that burns hotter - see the wikipedia page for all the details.

Here's my batch of thermite in action... http://uk.youtube.com/watch?v=_Z7XDDgf_ts

crucibles r us says: Nov 8, 2008. 6:14 AM **REPLY**

I thik i have just worked it out! if u use a little more aluminium powder that iron oxide (Fe2O3) by weight you should have the perfect amount of Fe2O3 molecules to Al atoms. Please correct if I am wrong, and please give me a reason why.

ams203 says: Nov 10, 2008. 7:02 AM **REPLY**

Hi Guys.
I was wondering if anyone knows of an alternative to barium nitrate for the military version.
Thanks

Dirk5 says: Jul 13, 2008. 5:21 PM **REPLY**

I USE PLAYDOUGH WORKS GOOD

Dirk5 says: Jul 13, 2008. 5:24 PM **REPLY**
for making it a solid piece

Grey_Wolfe says: Jul 17, 2008. 2:02 PM **REPLY**
Plaster is highly effective as well, but depending on how you make it, it's more of a bomb than just a burning chunk.

conrad2468 says: Sep 6, 2008. 11:09 AM **REPLY**
thanks cause i almost made one....

Grey_Wolfe says: Sep 8, 2008. 10:33 PM **REPLY**
Yeah, you don't want to do that, it will explode and throw white hot slag in all directions. It doesn't burn any cooler, it just makes it much more widespread.

cowscankill says: Oct 17, 2008. 7:37 PM **REPLY**
Wait, what? Why use play-doh or clay or whatever? For making a solid plantable (as in planting a bomb) package? That would be cool... Have a little fuse, well big, and jam a blob on a door knob to get in a house.

Grey_Wolfe says: Oct 20, 2008. 1:39 PM **REPLY**
He was talking about making it solid.

We were discussing using clay or plaster. Plaster solidifies well with thermite and maintains function, but it explodes.

For what you just suggested, I'd use a wax base. It will be more malleable. Though, a simple fuse wont do the job. Need magnesium or a similarly hot burning material to light the thermite.

A good source of wax are the candles in glass at the dollar stores. Usually have religious or inspirational pictures on them. It stays soft.

cowscankill says: Oct 20, 2008. 3:21 PM **REPLY**
I meant for the fuse (or is it fuze in this case?) to be a magnesium strip in the thermite with a visco fuse wrapped around it. That way, the fuse would be easy to ignite. Would the visco fuse set off the magnesium though?

Berkin says: Oct 25, 2008. 7:12 AM **REPLY**
Magnesium is a very good conductor of heat. Any kind of spark or flame will set it off, and the heat will transfer to the other side of the strip, like a fuse.

cowscankill says: Oct 25, 2008. 7:37 AM **REPLY**
Ok, So now I just need magnesium...

Berkin says: Oct 29, 2008. 9:55 AM **REPLY**
Just stick a strip into the thermite, light it and get away, unless you like showering in molten iron. Also, make sure the strip is long enough to give you time to get away.

SKINZ says: Jul 31, 2008. 8:09 AM **REPLY**
WHAT COULD LIGHT IT OTHER THAN A SPARKLERS OR MAGNESIUM. WOULD GUN POWDER LIGHT IT?

chunkymuggen says: Oct 3, 2008. 1:05 PM **REPLY**
a flare would definatly work.

Grey_Wolfe says: Sep 8, 2008. 10:34 PM **REPLY**
Has a very high ignition temp. I'm fairly certain that gun powder doesn't burn hot enough. Also, since gun powder is a flash burn, it wouldn't maintain the heat long enough to ignite thermite.

You can manage to light it with a blow torch.

SKINZ says: Sep 9, 2008. 5:02 AM **REPLY**
yer i no i tried it in the end i got sum magnesum

flppy says: Sep 27, 2008. 7:58 AM **REPLY**
homemade black powder could light it easily
also, you can ignite it simply with matches or matchheads just put some on the top of the thermite :D

Berkin says: Oct 25, 2008. 7:13 AM **REPLY**
wrong-o~

SKINZ says: Sep 27, 2008. 8:59 AM **REPLY**
hi and welcome to instructables, i tried gun powder out of shot gun shells no go il stick to the magnesum alot easier

flppy says: Sep 27, 2008. 11:02 AM **REPLY**
thank you
as you can see, i said HOMEMADE black powder :D
i dont know whats the difference, but my noob homemade black powder burns much more intensively than the one i get from for example firecracker
also, it burns with more than 1500°C, so it have to ignite thermite easily :D

SKINZ says: Sep 27, 2008. 11:13 AM **REPLY**
ive been thinking of makeing some for a while recon im gunna il let you know how i get on

flppy says: Sep 27, 2008. 11:08 AM **REPLY**
by the way i also had problems igniting it for the first time, but i found out that the storm matches - or how its called :D - that was remained from sylvester, can ignite it in no time. =)

And to get magnesium, for me it's hardly possible. The only way could be ebay

Grey_Wolfe says: Jan 24, 2008. 3:04 PM **REPLY**
Fe2O3, iron oxide is actually referred to as Iron Scale. Rust (FeO2, IIRC) works also, but iron scale is better.

surfreak says: Mar 1, 2008. 1:32 PM **REPLY**
FeO2 is nonexistant. Fe(OH)2 exists but is a hydroxide, unsuitable for this purpose.

Iron on oxidizes to 2+ (ferrous) and 3+ (ferric) oxidation states. Common "rust" is Fe2O3, while other commonly found oxides are Fe3O4 (magnetite, ferrous-ferric oxide, or iron (II,III) oxide), FeO (wustite, ferrous oxide, or iron (II) oxide). Fe2O3 has different mineral forms (hematite and maghemite). Fe3O4 is iron scale, not Fe2O3.

Grey_Wolfe says: May 27, 2008. 1:05 AM **REPLY**
ouch, lol. Nah I deserved that. I got my numbers wrong.

My point was really that Iron scale works better than rust.

Thanks for clearing up the formula. Might as well be accurate.

Those were just the last numbers I saw for the named substances, and I they were wrong. Guess that happens when your high school chem teacher's degree is in biochem. He was the forgetful type. Good teacher though, just spacey.

thoraxe says: Jun 10, 2008. 12:28 PM **REPLY**
is iron scale the stuff that forms on iron when it is heated?

Grey_Wolfe says: Jul 16, 2008. 12:52 AM **REPLY**
It's another form of oxidation on iron, but I'm not certain what circumstances you'd need to produce it over rust.

I can't remember what my 9th grade chem teacher said about it, it wasn't in the book, but we discussed it, since the class was interested in the idea of cutting a car in half.

Might be able to wiki or google it though. And I think you can purchase it at united nuclear.

beavercleaver says: Jul 25, 2008. 4:26 PM **REPLY**

Put steel wool into a container and light it, the stuff left works well.
You can buy aluminum powder at any paint store, its metal flake you see in paint.
You can also put aluminum against a bench grinder and make your own.

Grey_Wolfe says: Jul 31, 2008. 4:53 AM **REPLY**

You know, I hadn't even thought of paint flake. Just kinda went right past it. Sometimes you don't think of the obvious.

Typically get a better grade with purchased alumiminun than homemade, but you're right, that would work. The finer the grade, the better.

Aluminum powder is much more effective than filings of coarser grade. It allows for a more homogeneous mix.

Grey_Wolfe says: Jul 31, 2008. 4:57 AM **REPLY**

Alumiminum? WTH? Where was I when I typed this?

Note to self: don't reply at 5am when I haven't slept.

And with that, I'm off to bed.

thoraxe says: Jul 17, 2008. 12:12 PM **REPLY**

because i'm guessing the scale that forms on iron contains carbon and other impurities from the fuel, therefore making Fe304 and more like Fe3C2O4 or sumthing

surfreak says: Sep 24, 2008. 7:26 PM **REPLY**

Dude... you can't just throw random elements into chemical formulas. Fe3C2O4 isn't possible. If there is carbon present in the metal/metallic oxide that forms, it's going to be dispersed throughout the metal, comparable to an alloy. It doesn't get put in the chemical formula, because it is NOT bonded to the iron or oxygen (in the atomic sense).

Lets end this debate once and for all. The end-all is that it does not matter what oxide of iron you have, as long as you are conscious of exactly what you have and adjust the ratios accordingly. The reaction will still proceed with unimportant changes in rate for nearly any purpose outside of the lab. Just realize that if you have FeO the reaction is going to take a lot less iron oxide by mass to oxidize the aluminum than other oxides.

In short, with regards to the necessary amount of iron oxide (by mass) to oxidize a given quantity of aluminum:

Fe2O3<Fe3O4<FeO

Basically you'll need a lot more FeO than the others to oxidize a given mass of aluminum (because a given mass of FeO contains less oxygen than the same mass of Fe3O4 or Fe2O3), but you'll hardly notice the difference in rate. The temperature of a magnesium strip should provide well more heat than necessary to overcome the activation energy for any of the reactions. This, however, does not take into account percent yield, which could be different for each of the three reactions; but I'm unwilling to look that up or experiment to find out more. Compute the necessary ratios by yourself after writing down the equations. If you don't know how to do this, you don't know enough to worry about it, so just mix up a bunch of "rust" and "aluminum" and stand well back.

Iron scale is still Fe3O4.

End.

Vendigroth says: Sep 22, 2008. 9:07 AM **REPLY**

The scale that forms on iron does contain some carbon, but not much. If I remember correctly, it's Fe3O4.

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