Analysis of Effective utilization of Exhaust Gases in an Automobiles

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Material Selection

Followings are the list of materials that can be used according to requirements.

Optimal Material

- $T_f - T_0 = 660\,\mathrm{K}$
- $d_1 = d_2 = 4\,\mathrm{mm}$, $b_1 = b_2 = 3\,\mathrm{cm}$
- $l_1 = l_2 = 1\,\mathrm{m}$
- Best pairs:

Pair	Cu-Ni	Al-Ni	Cu-Al	Sb-Ni	Sb-Const
I [A]	9.1	6.0	4.9	3.9	3.0

TABLE 1 COMPARISON OF THERMOCOUPLE TYPES

Thermocouple type	Conductors	Temperature range (°C)	Typical specified temperature range (°C)	Seebeck coefficient at 20°C (μV/°C)	Application environments
E	Chromel (+) constantan (–)	–270 to +1000	–200 to +900	62	Oxidizing, inert, vacuum
J	Iron (+) constantan (–)	–210 to +1200	0 to 760	51	Caccuum, oxidiz-ing, reducing, inert
T	Copper (+) constantan (–)	–270 to +400	–200 to +371	40	Corrosive, moist, subzero
K	Chromel (+) alumel (–)	–270 to +1370	–200 to +1260	40	Inert
N	Nicrosil (+) nisil (–)	–270 to +1300	0 to 1260	27	Oxidizing
B	Platinum (30% rhodium)(+) Platinum (6% rhodium) (–)	0 to 1820	0 to 1820	1	Oxidizing, inert
S	Platinum (10% rhodium) (+) platinum (–)	–50 to +1760	0 to 1480	7	Oxidizing, inert
R	Platinum (13% rhodium) (+) platinum (–)	–50 to +1760	0 to 1480	7	Oxidizing, inert

From the above listed materials we use the type J thermocouple that is ferrous and constant operated in the range of -200 to 1200 degree Celsius.

We use the Teflon sheet as a insulator to insulate the hot and cold side to make the effective temperature difference.

Material Used

- Type J Thermocouple
- Ferrous wire – 0.3 mm
- Constant (Ferrous-Nickle Alloy) – 0.3 mm
- Teflon Sheet – 0.5 mm

SPECIFICATION

The teflon coating needs no introduction... "a miracle in science" manufactured by DuPont as a non-stick industrial coating. The High level of Teflon fluoropolymer in this coating enhances lubricity and has a multitude of purposes.

NON-STICK

LOW COEFFICIENT OF FRICTION

HEAT RESISTANCE

CHEMICAL RESISTANCE

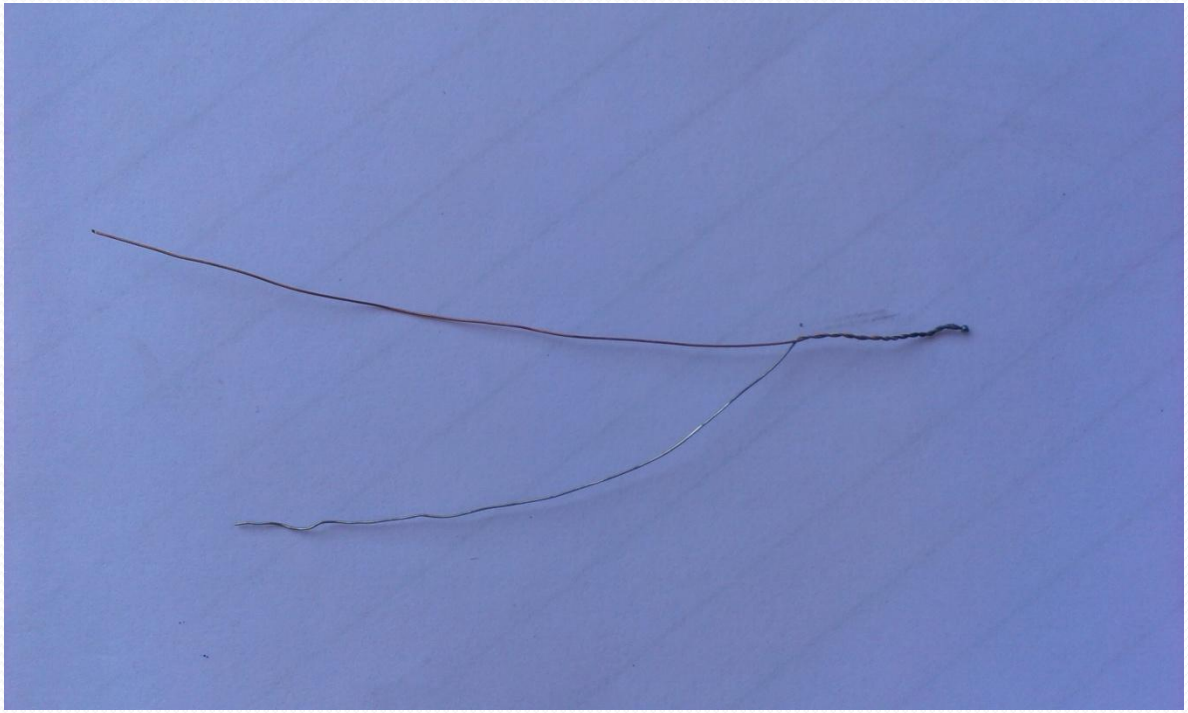
NON-WETTING

UNIQUE ELECTRICAL PROPERTIES

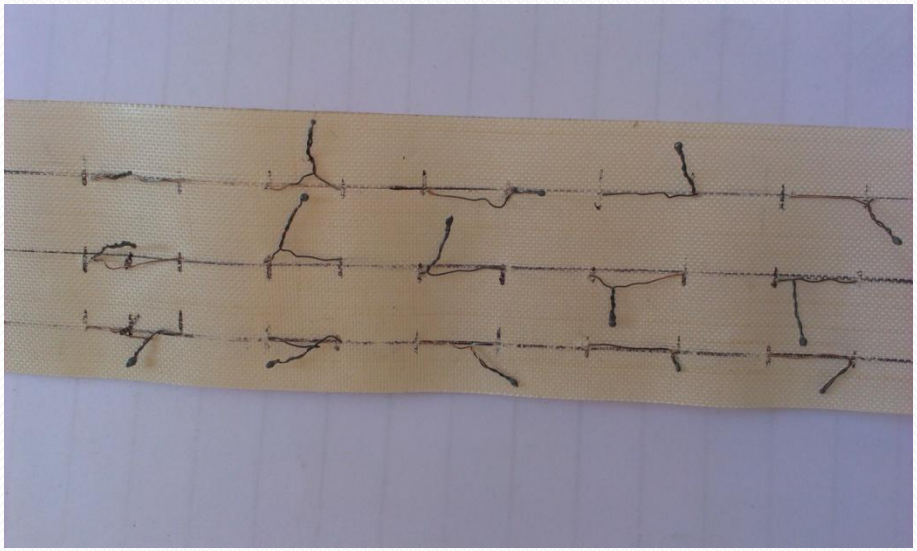
CRYOGENIC STABILITY

Ferrous Wire 0.3 mm

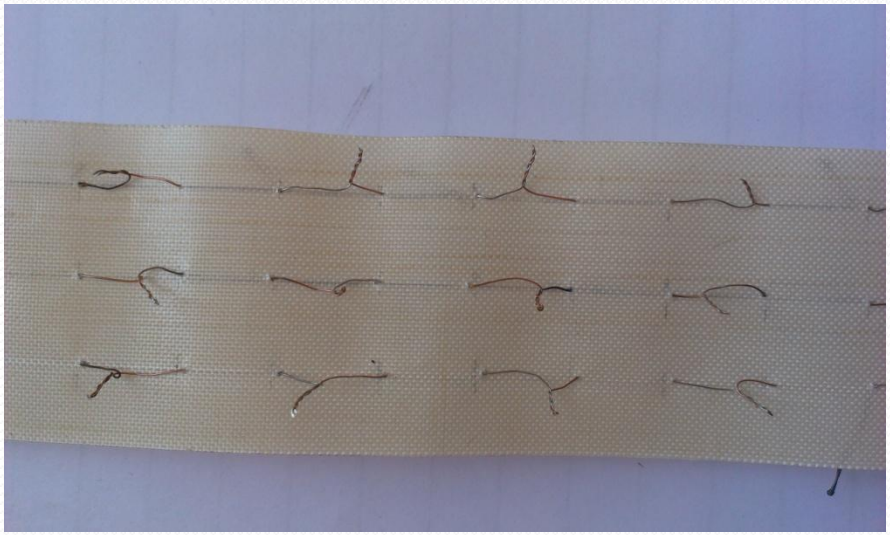
Constantan Wire – 0.3 mm



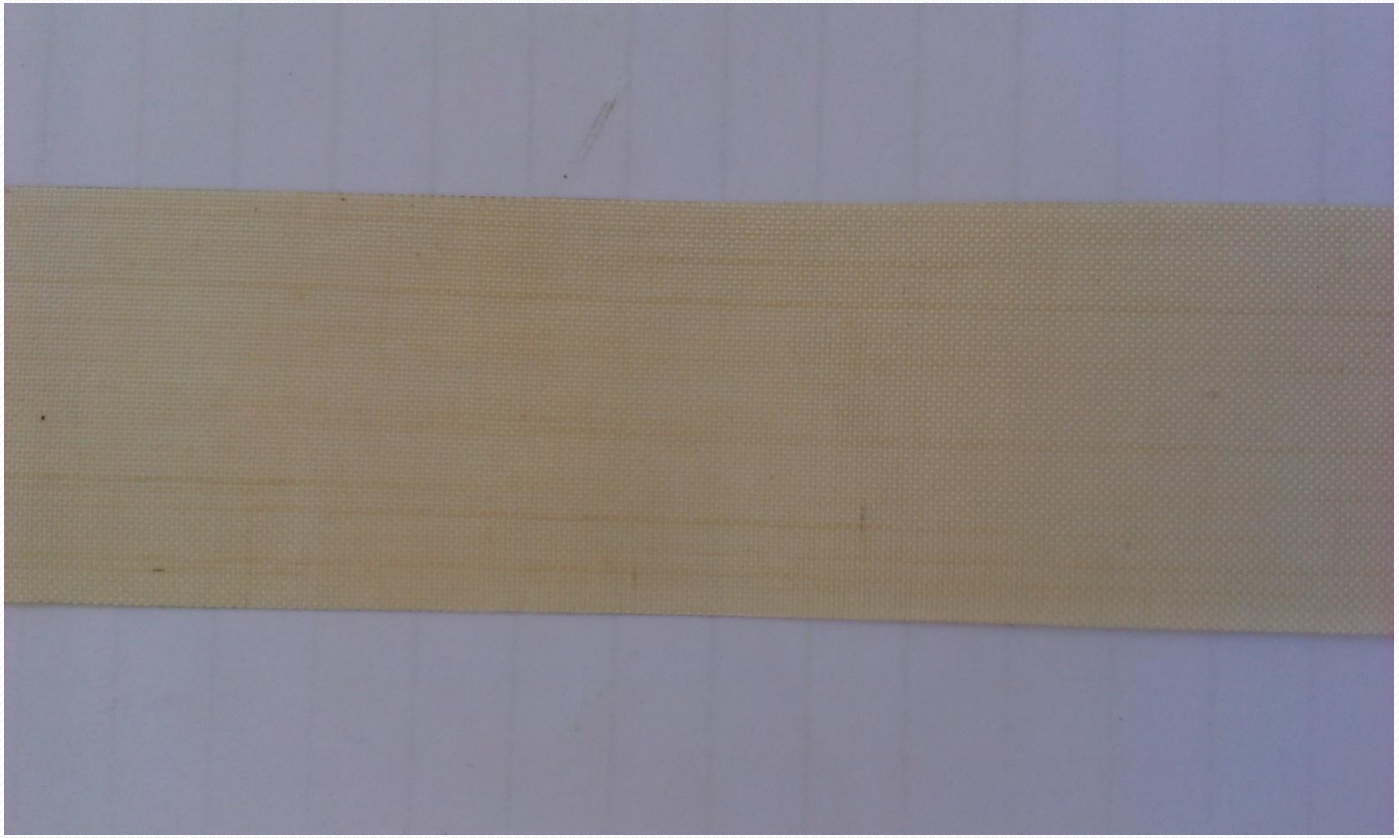
Thermocouple Junction of J Type



Hot Side Welded Junction



Cold Side Twisted Wires



Teflon Sheet

PROCEDURE

- First of all take the Teflon sheet.
- Marks the point on the sheet on which the thermocouples are placed.
- Take the two different materials to be welded to gether.
- Cut them to proper length.
- Take the oxy-acetelen gas tourch.
- Heat the to wires and heat them till they weld and make the junction and let solidify them.
- Twist the other end of the couples and make the series or parallel connection according to requirement.
- Repeat the above steps to make the complete sheet of thermocouples.
- Now install the sheet to the place where the hest is required to be recovered i.e at the exhaust side of an automobiles.
- Measure the voltage and ampere generated at the end of the circuit.

RESULTS

Hot Side Temperature (°C)	Cold Side Temperature (°C)	Voltage (V)	No. of couples
120	80	0.20	150
120	80	0.09	60
120	80	0.25	150
120	80	0.18	150
120	80	0.15	130