CHAPTER 4

RESULTS AND DISCUSSION

This chapter will be discussed all results that are obtained from testing that was mentioned before in the previous chapter.

4.1 Sensor characteristic Test

Table 4.0 shows the results from "Sensor Characteristic Test" for BTST thin film sensor which was the annealed at 900 ^{O}C. Meanwhile, in Figure 4.0, the graph has been produced by using data in Table 4.0. In Table 4.0, for each 2^{o}C change in temperature, the resistance decreased around 5kΩ to 30kΩ. For analysis, Figure 4.1 has been produced and used to calculate the expected result. From Figure 4.1 also, it shows how temperature coefficient resistance can be obtained from the slope. Then, the temperature coefficient was been used to find ΔR (see equation **(3.2)**). From result obtained, when the temperature increases, the resistance decrease. The characteristic is similar to negative temperature coefficient (NTC). It also can be said that NTC occurs when the thermal conductivity of the BTST thin film sensor decreases with increasing temperature normally in a defined temperature range. [11]

Table 4.0: The results from experiment for BTST sensor characteristic

TEMPERATURE (^{O}C)	RESISTANCE VALUE(kΩ)		
	1	**2**	**3**
38	735	745	749
40	722	730	736
42	710	725	721
44	694	696	714
46	681	675	702
48	669	660	693
50	653	642	679
52	640	629	659
54	628	618	644
56	612	607	631
58	599	593	619
60	587	581	603

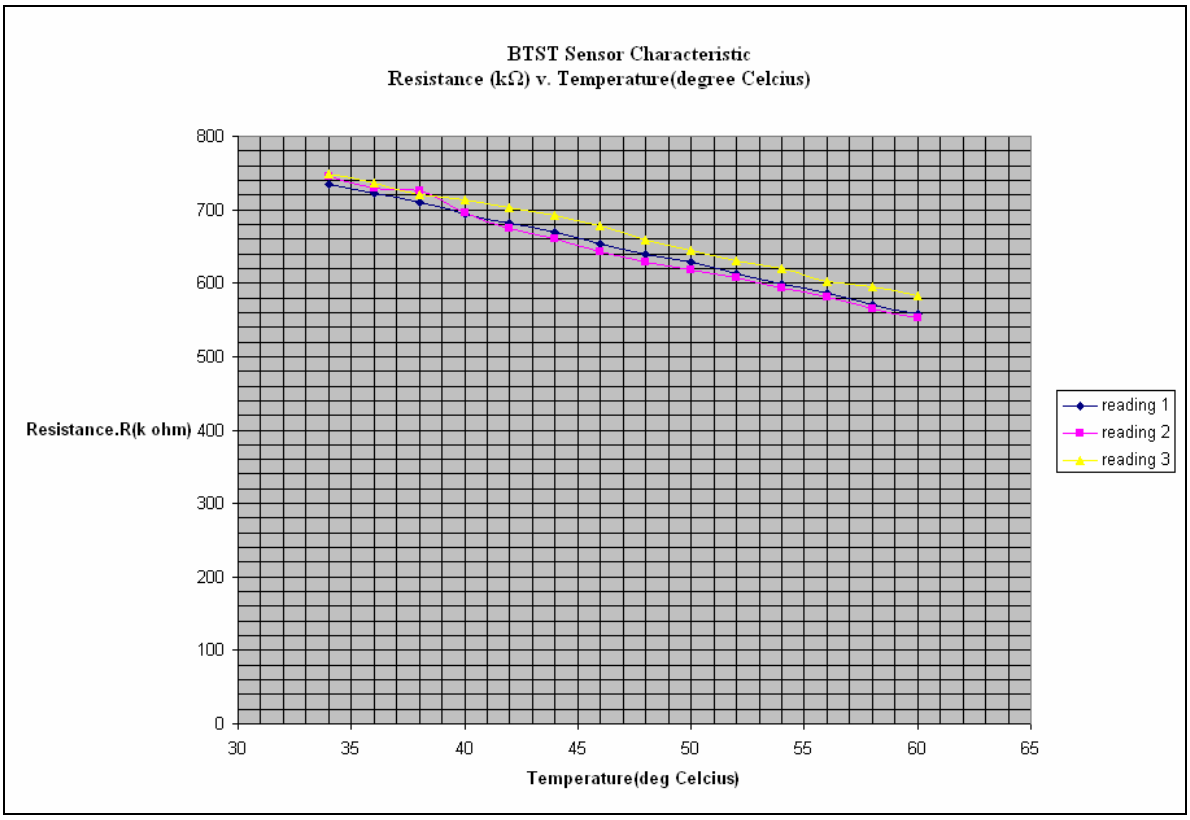

Figure 4.0: BTST Sensor Characteristic, Resistance (kΩ) v. Temperature (^{o}C)

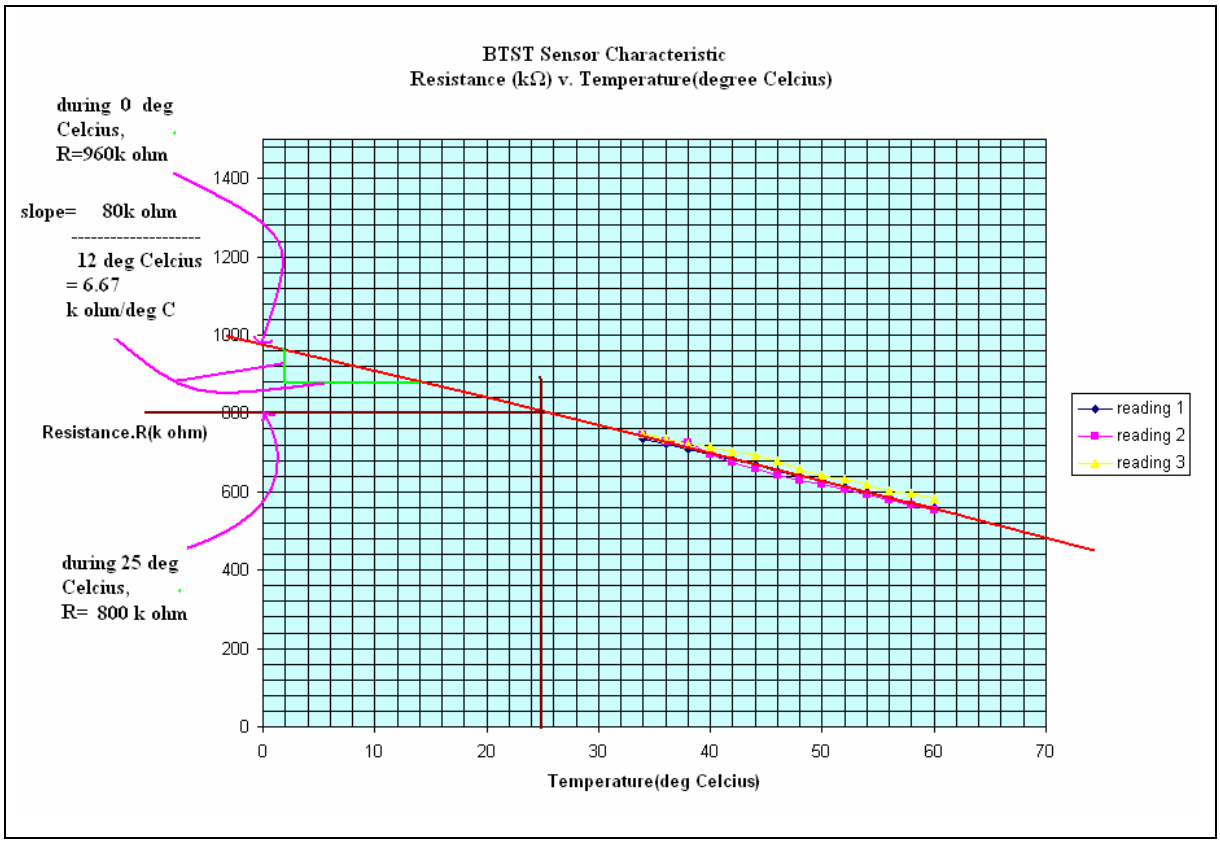

Figure 4.1: The Analysis of BTST Sensor Characteristic.

4.2 Circuit design test

Therefore, from the slope in Figure 4.1, the calculation for expected voltage output from the sensor part can be found by using the equation **(3.8)**. The expected result can find at Table 3.1 and Table 3.2. Table 4.1 shows the experimental result that obtained from circuit design testing. From the result, for 2 ^{o}C increased, output voltage also will be increased 0.01 V. From Table 4.1, the output voltage increase by 0.01 V for each increases of 2^{o}C. Figure 4.2 was produced from results in Table 4.1. From Table 3.1, Table 3.2 and Table 4.1, there are slightly a big difference result produce between calculation and experimental circuit.

Hence, from the circuit analysis that was done under subtopic 3.1.2, the equation **(3.8)** depends to ΔR. ΔR is actually obtained from the experimental analysis of sensor characteristic test. Therefore, to prove the output from the sensor part is right, simulation has been done by using OrCAD 9.1 software. From the simulation, the result that is produced actually is same as the output voltage that was produced from the experiment. Beside that, from the Table 3.1 and Table 3.2, the results produce as expected same as the slope of graph except the values that was produced from the circuit design test. From the result at the Table 4.0, it can be said the sensor characteristic was being interfered by other sources such as infra-red, gas and many more that BTST thin film can be sense during testing were be done. For this reason, a lots of parameters need to be taken in an account during the testing. Thus, in the future, the tester needs to aware before do the test for prevent this problem repeated.

Table 4.1: Output voltage from sensor and instrumentation differential amplifier part.

No.	Temperature (^{o}C)	Reading value measure (V)		
		1	2	3
1	32	3.53	3.53	3.51
2	34	3.54	3.54	3.52
3	36	3.54	3.55	3.53
4	38	3.55	3.56	3.54
5	40	3.56	3.55	3.55
6	42	3.57	3.56	3.56
7	44	3.58	3.57	3.57
8	46	3.58	3.58	3.58
9	48	3.59	3.59	3.59
10	50	3.61	3.6	3.6
11	52	3.6	3.61	3.61
12	54	3.6	3.62	3.62
13	56	3.62	3.63	3.62
14	58	3.63	3.63	3.63
15	60	3.63	3.62	3.63

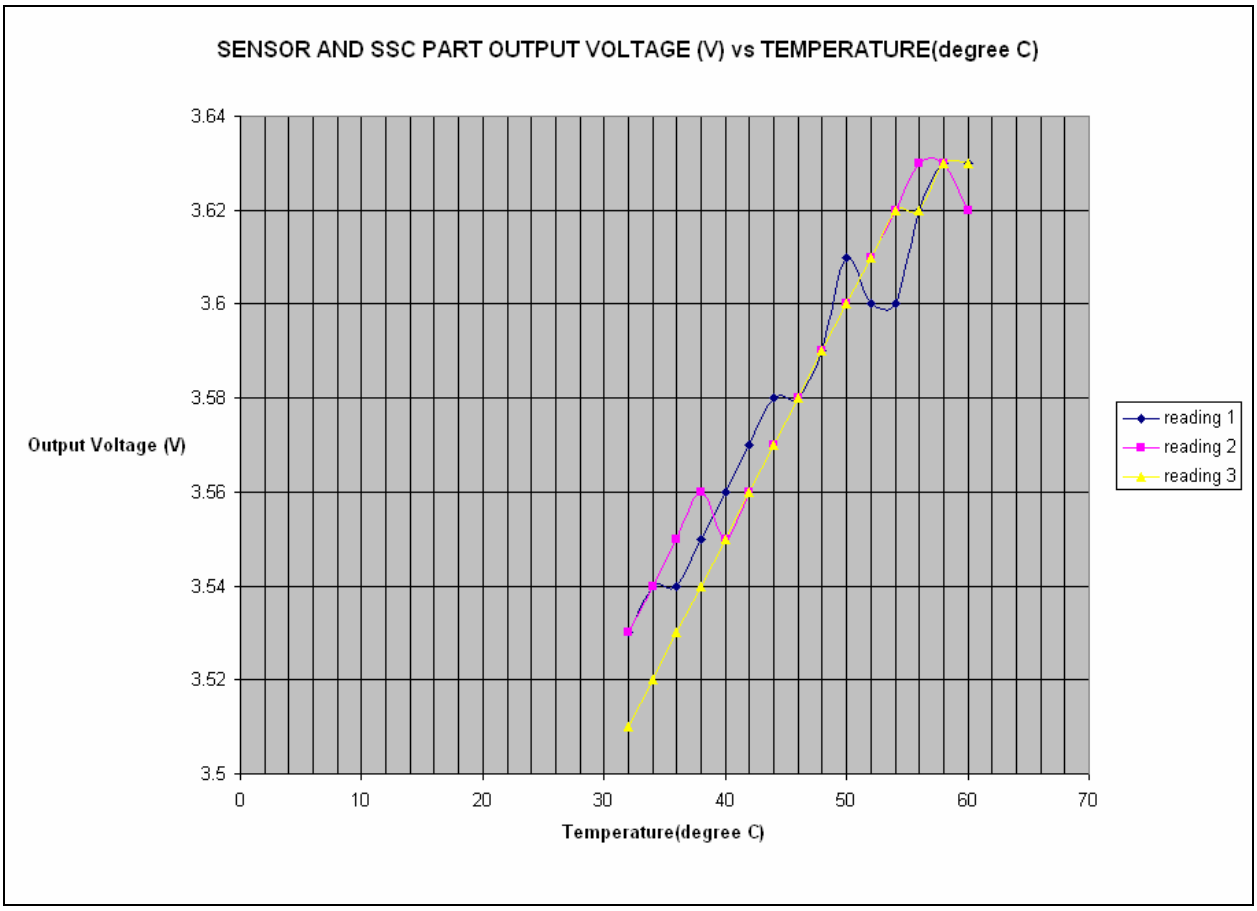

Figure 4.2: Graph of Output Voltage V. Temperature