

MERIT internship report (abroad)

MERIT 3rd grade

Department of Electrical engineering and Information Systems

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Period: 1st November, 2016 – 27th January, 2017

Institution: IMEC (Leuven, Belgium)

ABOUT IMEC:

I participated in an internship program at IMEC in Belgium from November 2016 to January 2017. IMEC is an international research institution on electronic devices and has a head-quarter office in Leuven. IMEC was once founded by Flemish Government. However, it is supported by international companies and universities now and shares scientific and technological outcomes with their partners. IMEC is one of the most leading research institution in electronic devices. Its research fields range from state-of-the-art CMOS logic circuits to bioelectronics and emerging devices for the future applications. In this internship, I experienced the studies on spin-wave devices.

SPIN WAVE:

In cutting-edge large integrated circuits, the metal interconnection becomes more and more complicated with the development of scaling and cause the increase in production cost. Majority logic circuits catch a lot of attention as a possible solution for this problem because it can simplify the complicated interconnections. A majority logic circuit is a circuit which outputs majority inputs for odd 1bit inputs. For instance, it outputs 1 for 5 inputs of 1, 1, 0, 0, 1. Majority logic circuits enable us to reduce the number of interconnections largely and simplify them. Spin wave is one of the most promising physics for the realization of majority logic circuits. Spin wave is a phenomenon that magnetic moments in magnetic materials propagate as a form of wave. It was merely an interesting physical phenomenon, however many engineers pay a lot of attention from technological point of view because the phase of spin wave can be utilized as a bit and majority logic circuits can be constructed by its interference. IMEC is pushing forward spin wave majority logic circuits from experimental and theoretical aspects.

ACTIVITIES:

I brought samples fabricated in my laboratory and studied toward the measurements of spin wave in these materials. Spin wave can be detected as a secondary peak of ferromagnetic resonance. In

this internship program, I studied for measuring spin wave by vector network analyzer.

First, I designed coplanar wave guide in order to generate AC magnetic field with GHz frequency and fabricated photomask. The wave guides were designed for substrates with various dielectric constants. Then, I fabricated spin wave devices using the fabricated photomask. The Photomask was designed so that we can pattern coplanar wave guides with different dimensions. Unfortunately, I could not measure the fabricated device due to the time limitation. I will discuss future plans with group members.

SUMMARY:

Through this internship program, I was able to experience foreign researches. Through this experience, I could review research environments in Japan objectively. In addition, this internship helped me realize myself. However, unfortunately, I could not get as many first-hand experiences as I expected.

ACKNOWLEDGEMENT:

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