# The effect of cooling and extrusion temperature on mechanical properies of PVC coated yarn

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## 1. INTRODUCTION

The coated yarn (Core-Sheath) which uses PVC as coating materials is used sunscreen, wallpaper, floors. Its consumption is expected to be far higher than now. Production of coated yarn is divided by extruding, cooling, drawing, taking up process. These processes (extruding, cooling, drawing, taking up) are important part of determining material high performance and productivity.

In the middle of coated yarn and adhesion of between core yarn (PET) and coating material (PVC) is also important part of faulty of complete production. Adhesion of coated yarn is subject to changed by cooling conditions to cool which are generated high heat of extruding process. The purpose of this research is to review effect of cooling and extrusion temperature on mechanical properties of PVC.

## 2. EXPERIMENTAL

### 2.1. Materials

Coating material (PVC) is used to chips which are mixed PVC, plasticizer, stabilizer, nonflammable material in Microcam company. and core (PET) is used to PET of 250 denier (DTY) which is manufactured in Hyo-sung company.

### 2.2. Conditions

Table1. Cooling and extrusion temperature

| | 40℃ | 30℃ | 20℃ | 10℃ |
|---|---|---|---|---|
| 165℃ | CASE.1 | CASE.2 | CASE.3 | CASE.4 |
| 170℃ | CASE.5 | CASE.6 | CASE.7 | CASE.8 |
| 175℃ | CASE.9 | CASE.10 | CASE.11 | CASE.12 |

### 2.3. Mechanical test

Tensile strength is measured a strength testing machine and cross-section is measured SEM testing machine.

## 3. RESULTS AND DISCUSSION

### 3.1. Anylsis of thermal properies

It shows measurement the DSC of coating material (PVC) that is the biggest liquidity between 160℃ and 180℃. And it begins pyrolysis at the point of 180℃. It shows measurement the TGA of coating material (PVC) depending on temperature change. It is similar to result of DSC thst is deadly decreased weight of ratio at the point of 180℃.

So It is applied heat inside temperature of extruder to the front and the rear 180℃ and is not occurred pyrolysis and is the biggest liquidity. It attach extrusion temperature with at 165℃, 170℃, 175℃.

### 3.2. Anylsis of physical properies

Fig.1. shows progress of tensile strength for coated-yarn and coating material (PVC) dependingextrusion or cooling temperature. We can see core-yarn (PET) absolutely affects to progress of strengththetrue that tensile strength of PVC coated yarn is remarkably higher than coating material (PVC) itself. Generally, tensile strength depends on crystallization of polymer and adjusting cooling temperature for coated yarnvery important factorsince crystallization can be influenced by taking up velocity or cooling conditions.

Fig.2. shows progress of tensile strength for coating material (PVC) depending on extrusion or cooling temperature. first off, extrusion temperaturethe higher, strengthhigher, which comes to the peak at the point of 175℃. When extrusion temperature is 175℃, pyrolysis does not occur, at the same time, liquidity of viscosity maximize crystallization. Secondly, cooling temperature is the higher, tensile strength is the higher, whichenable us to guess crystallization of the extruded PVC at the high-temperature isin anneal-procedure than in quenching-procedure. Even though coating material (PVC) is non-crystallized polymer (crystallization ab.9%), welearn through SEMit is possible tocrystallization highon extrusion or cooling temperature. At the same time, tensile strength goes up owing to improved-adhesion between core-yarn (PET) and coating material (PVC). And extrusion or cooling temperature is the higher,is the higherso shrinkage tois not so big

PVC is thermoplastic polymer but, by adding plasticizer, has characteristic of elastomer, at the same time, its strength is necessarilytoits elongation just like Fig.4.

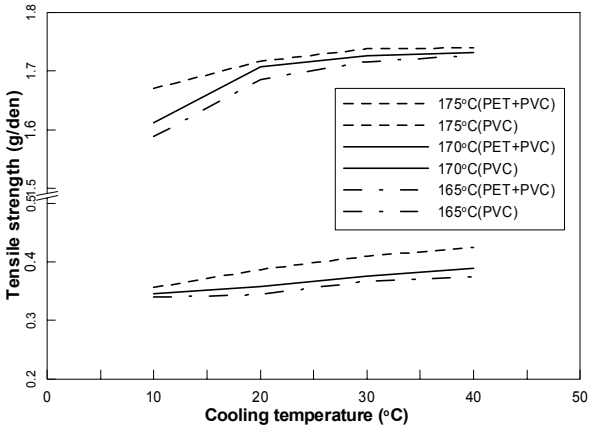


**Fig. 1.** Tensile strength of coated yarn and coating material (PVC) according to the cooling and extrusion temperature.

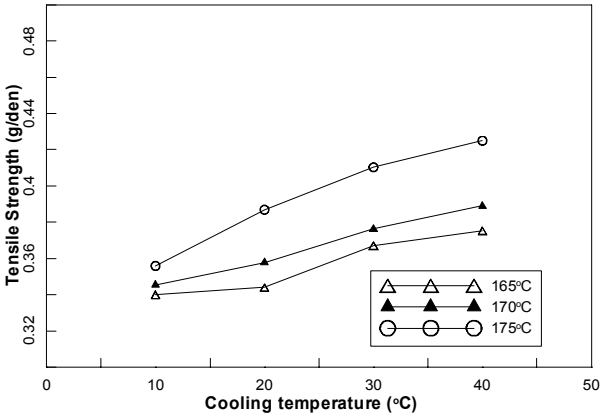


**Fig. 2.** Tensile strength of coating material (PVC) according to the cooling and extrusion temperature.

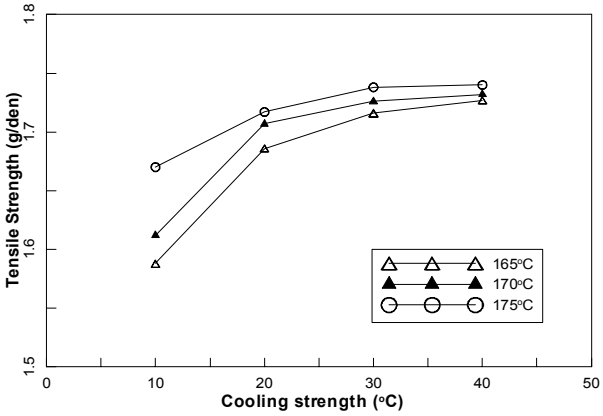


**Fig. 3.** Tensile strength of coated yarn according to the cooling and extrusion temperature.

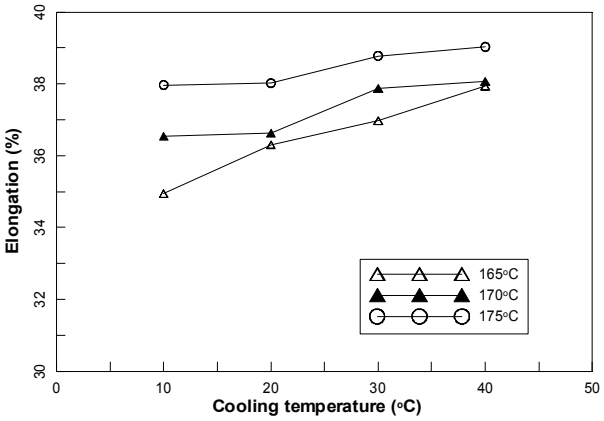


**Fig. 4.** Elongation of coated yarn according to the cooling and extrusion temperature.

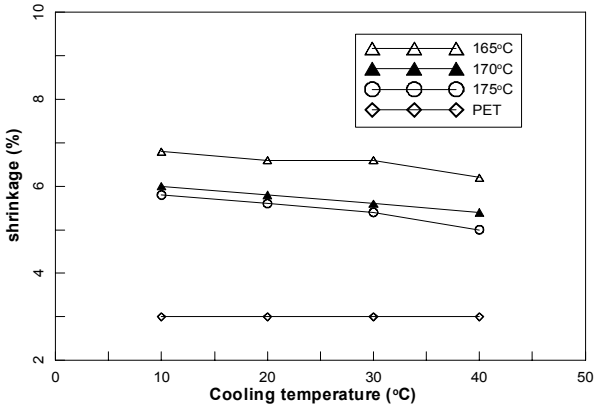


**Fig. 5.** Shrinkage of coated yarn according to the cooling temperature and extrusion temperature.

## 4. CONCLUSION

1) Extrusion temperature is the higher, crystallization of coating material (PVC) is the higher and is improved of adhesion between core-yarn (PET) and coating material (PVC).
2) Cooling temperature is the higher, crystallization of coating material (PVC) is the higher and is improved of adhesion between core-yarn (PET) and coating material (PVC).
3) Extrusion and cooling temperature is the higher, shrinkage to heat is not so big.
4) Coating material (PVC) is thermoplastic polymer but, by adding plasticizer, has characteristic of elastomer.

## 5. REFERENCES

[1] John J. Aklonis, William J. MacKnight; Introduction to Polymer Viscoelasticity, pp 36-83,1982.