Development of the soft plastic material which has a good workability and ability of crack prevention with special fiber

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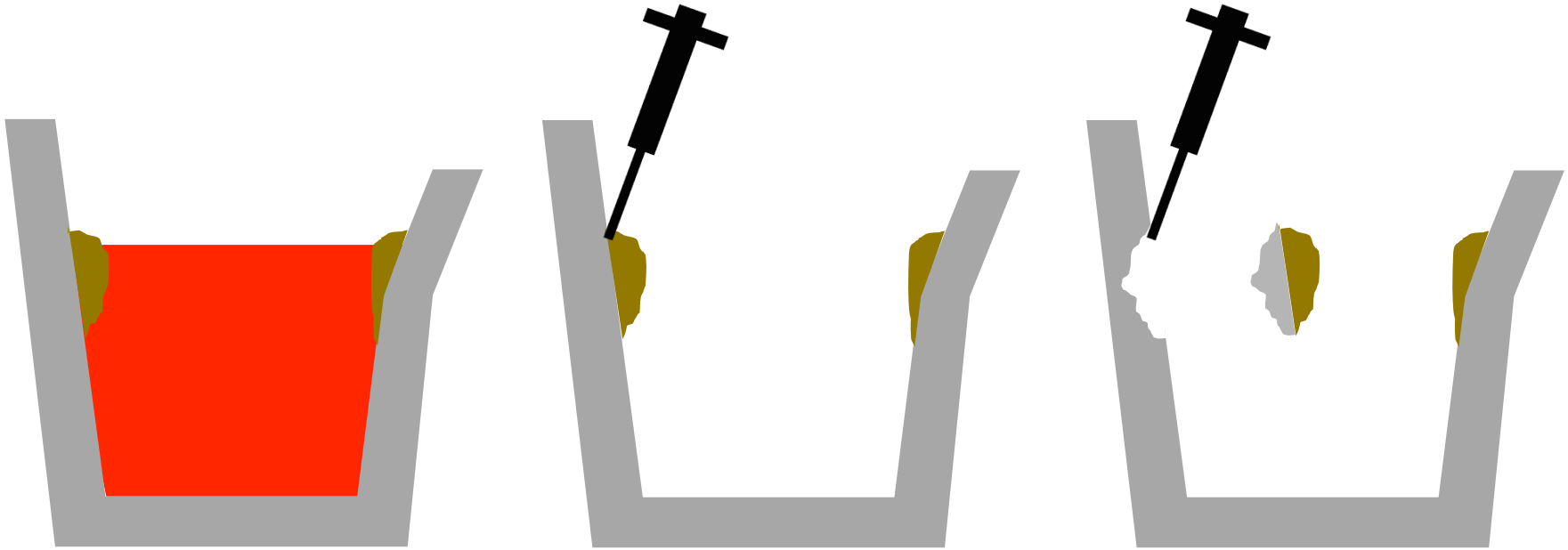
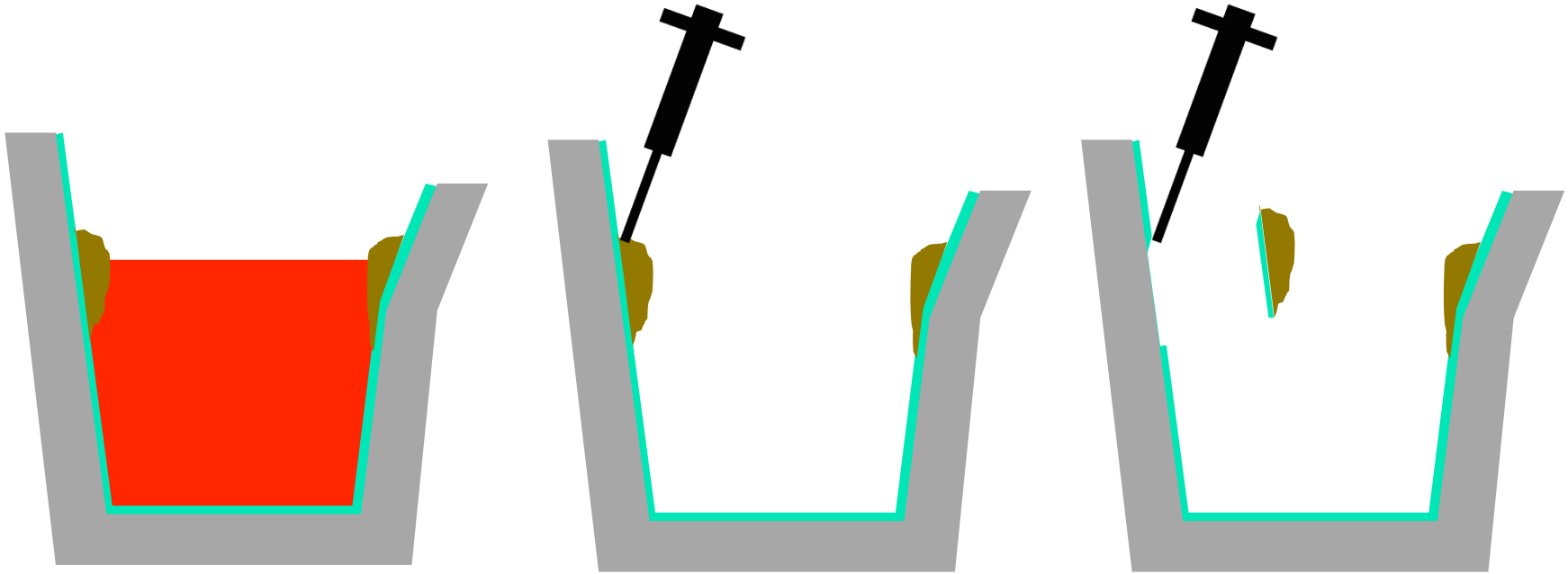
Introduction(Conventional material)



Introduction (Soft plastic material)



Required Character for the soft plastic material

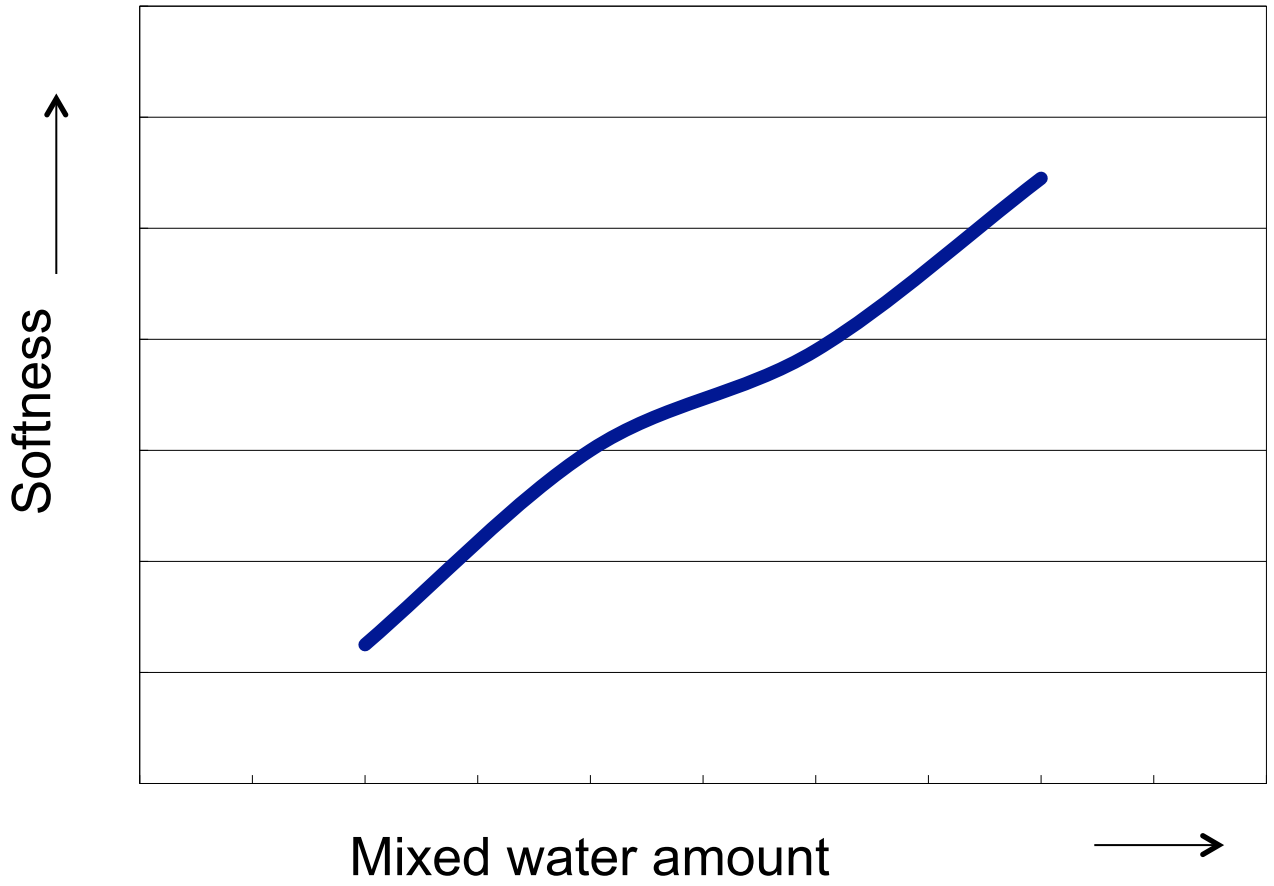
- Good Workability
- Crack Prevention
- Good adhesion
- Installability with proper thickness (0～50mm）

Base plastic material

Maximum Applicable Temperature (℃)	1650
Chemical Composition (%)	Al2O3 : 67 SiO2 : 26
Cold Crushing Strength（MPa）1400℃×3 h	25
Installation Amount（kg/m3）	2600

Workability of the soft plastic material

- **Relationships between the softness and mixed water amount**



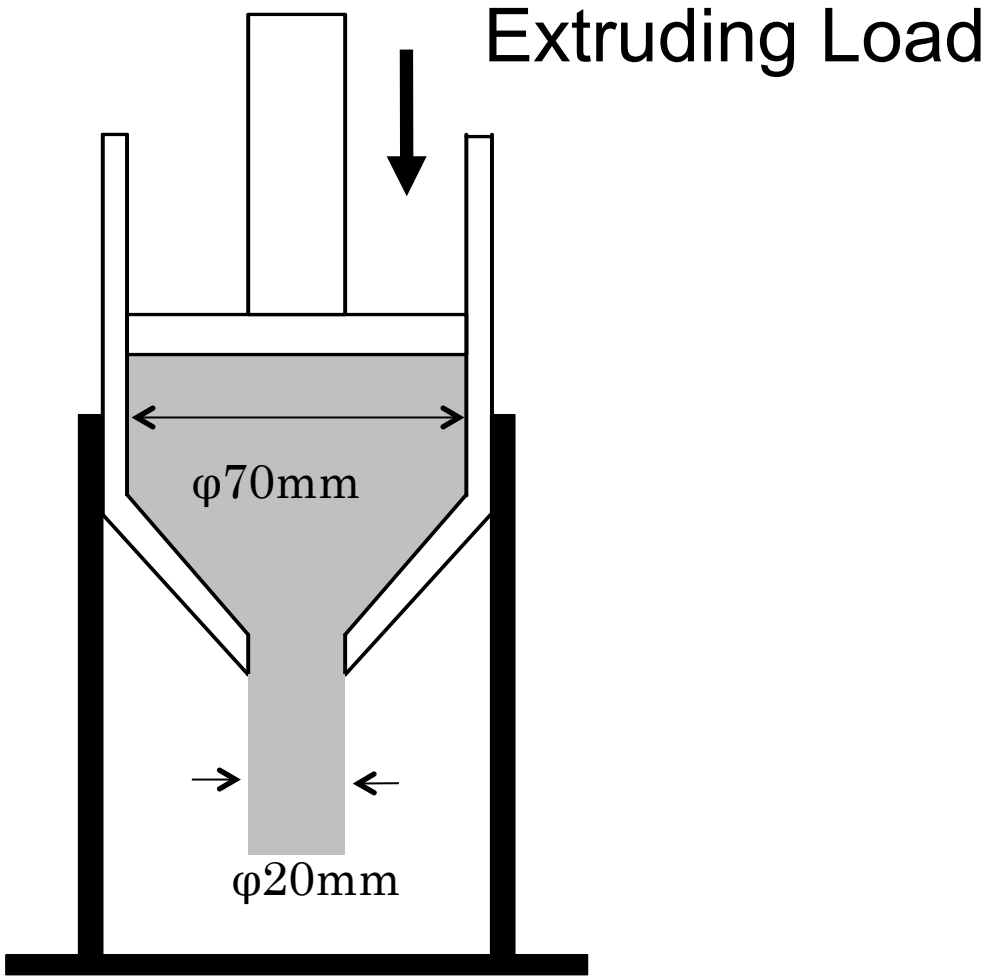
Evaluation of the workability 1

- **Evaluation of the workability　（better　4＞3＞2＞1 worse）**

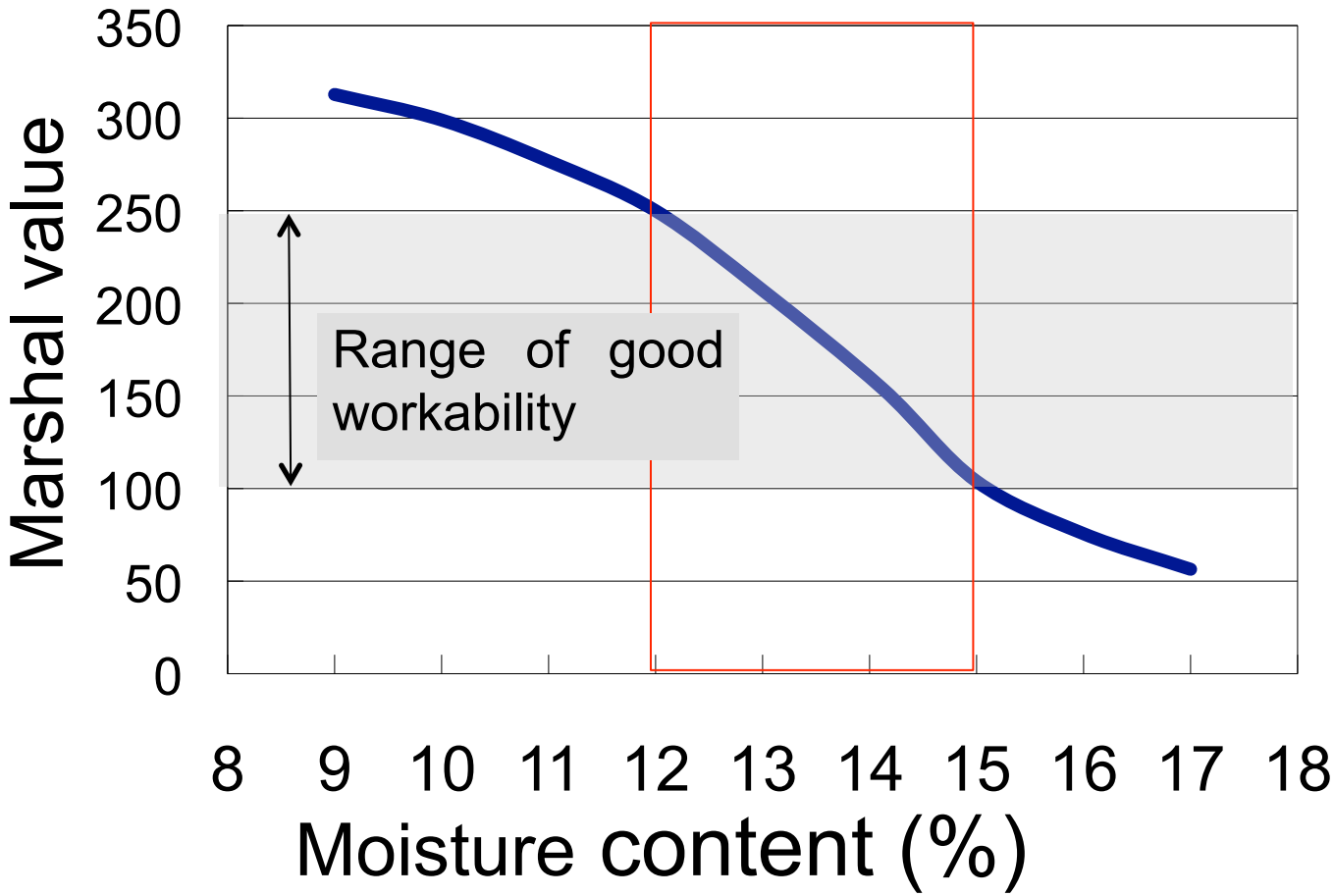
Moisture %	9	10	11	12	13	14	15	16	17
Evaluator A	1	1	2	3	4	4	3	2	1
Evaluator B	2	2	2	3	4	4	4	3	2
Evaluator C	1	2	3	4	4	3	3	2	1
Evaluator D	1	2	2	3	4	3	3	2	2
Evaluator E	1	1	2	3	4	4	3	2	1
Total	6	8	11	16	20	18	16	11	7

Good workability

Sketch of the Marshal test



Relationships between moisture and the Marshal value



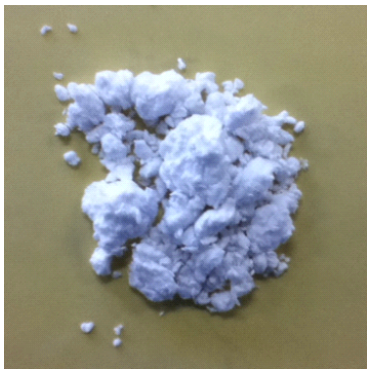
Relationships between moisture value and the number of crack

Moisture %	9	10	11	12	13	14	15	16	17
Number of crack	0	0~2	0~3	2~4	2~5	2~6	3~7	4~8	4~9

[Test Conditions]

- Crack width is 2mm or more
- Sample size is 600mm x 400mm with 30mm thickness

Samples of fibers applied for the experiment

Sample 1	Sample 2	Sample 3
Organic Fiber	Organic Fiber	Organic Fiber
		
Sample 4	Sample 5	Sample 6
Inorganic Fiber	Inorganic Fiber	Carbon Fiber
		

Evaluation of the dispersion

Fiber sample	Type	Dispersion
Sample 1	Organic 1	◎
Sample 2	Organic 2	◎
Sample 3	Organic 3	◎
Sample 4	Inorganic 1	×
Sample 5	Inorganic 2	×
Sample 6	Carbon fiber	◎

◎：Good dispersion　　×:Bad dispersion

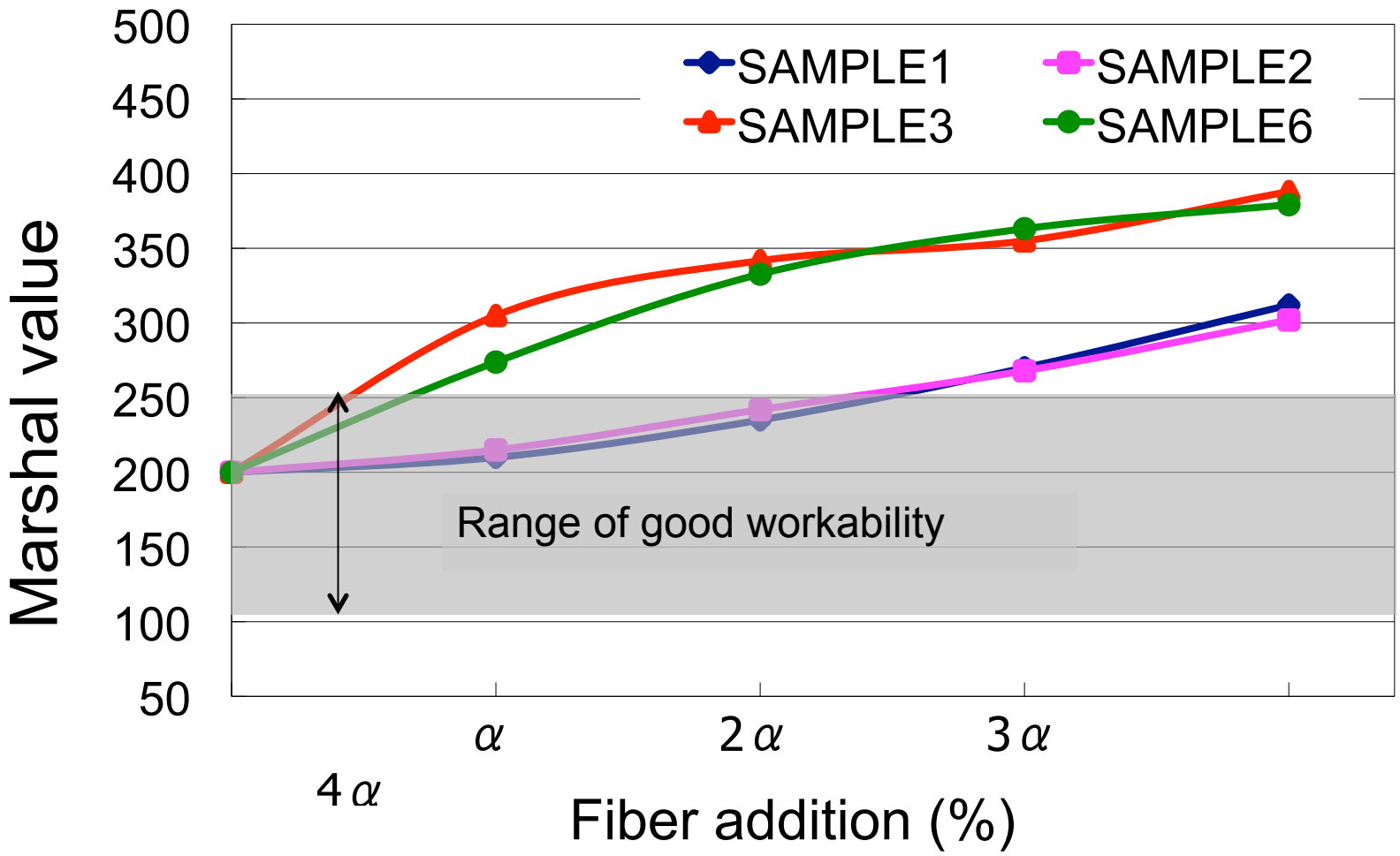
Workability evaluation

- Test condition　(better　4＞3＞2＞1　worse)
- Moisture percentage is fixed at 13%

Fiber addition	0 %	α %	2α %	3α %	4α %
Sample 1	20	18	17	11	6
Sample 2	20	17	16	9	6
Sample 3	20	10	8	6	5
Sample 6	20	10	9	5	5

Range of Good workability

Workability evaluation 2



Crack appearance 1

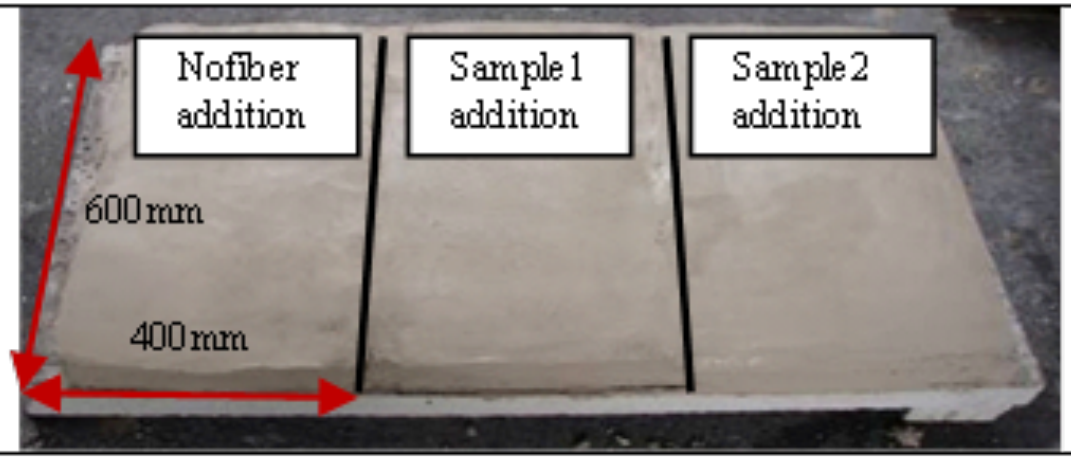
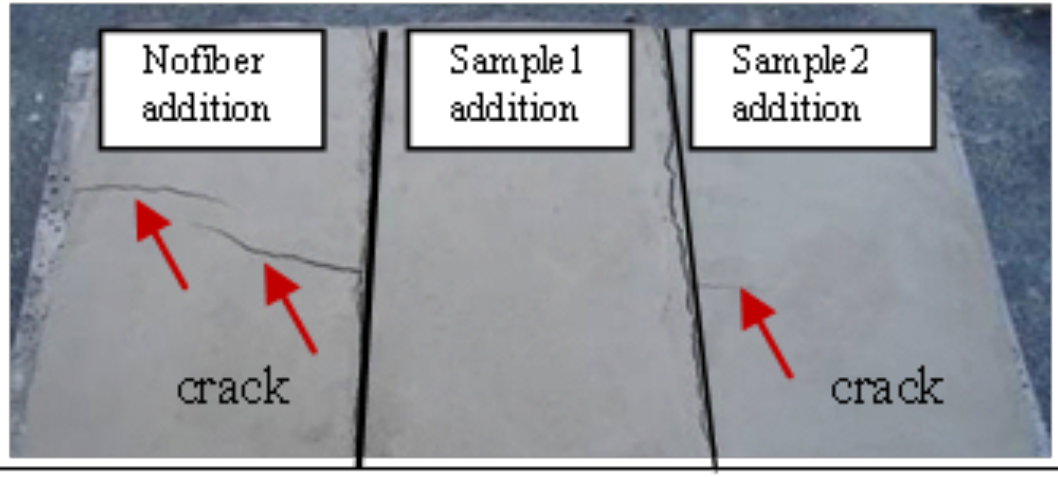
Type	0%	α%	2α%	4α%
Sample 1	×	△	◎	◎
Sample 2	×	×	△	◎

◎:No crack

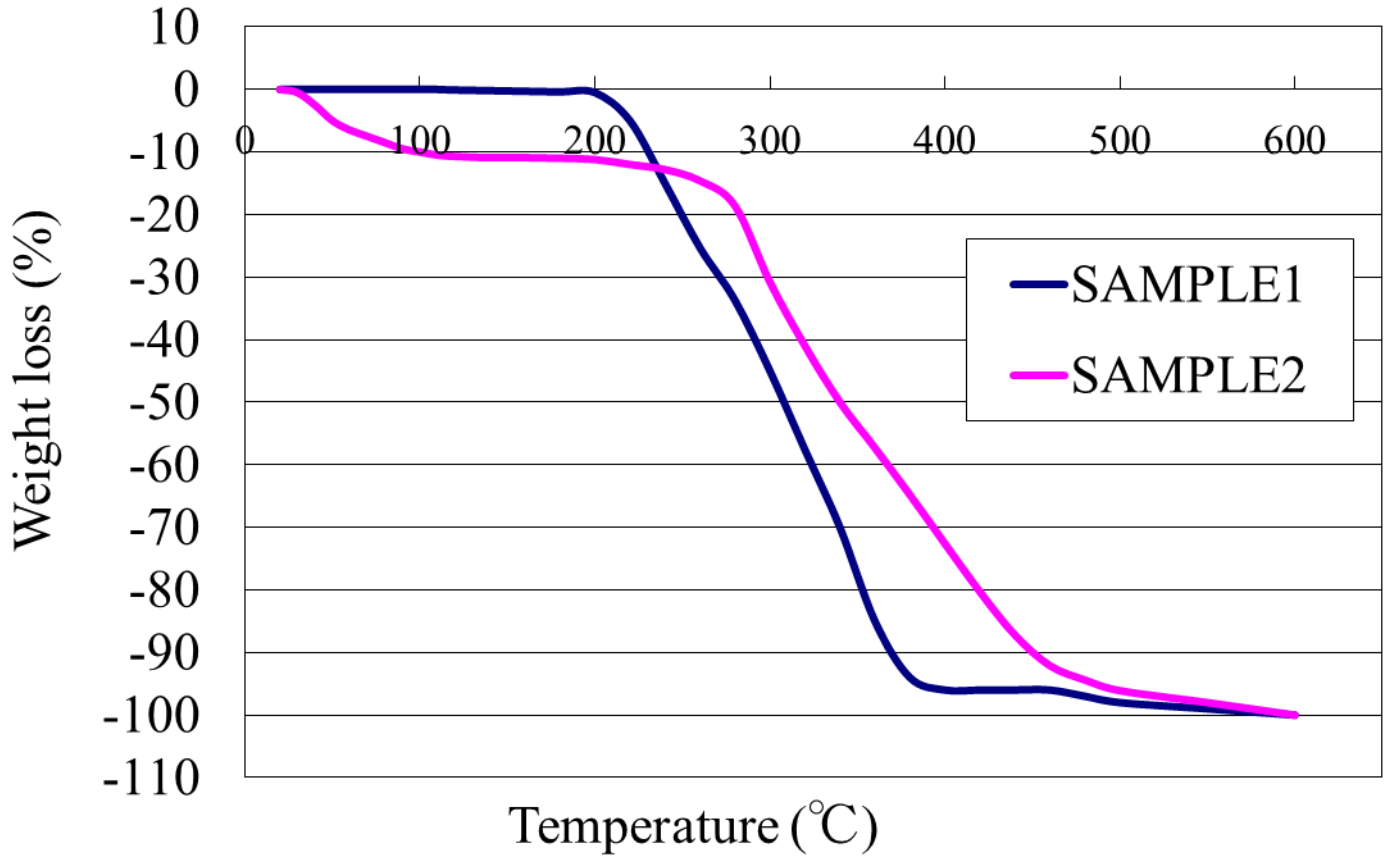
△:Fine cracks　(The width is below 2mm)

×:Large cracks (The width is more than 2mm)

Crack appearance 2

	Pictures of the sample
Soon after the installation	
After curing	

Crack appearance 3



Conclusion

- Moderate water addition improved the workability of the plastic material but the cracks appeared during curing process.
- The fiber was added to prevent the cracks but the applied fiber should have specific property.
- The dispersion and the maintaining of the workability are required for the character of fiber in addition to the crack control.
- A moderate range of fiber addition existed by maintaining the balance of workability and the crack control.
- The workability could be evaluated by the Marshal value.